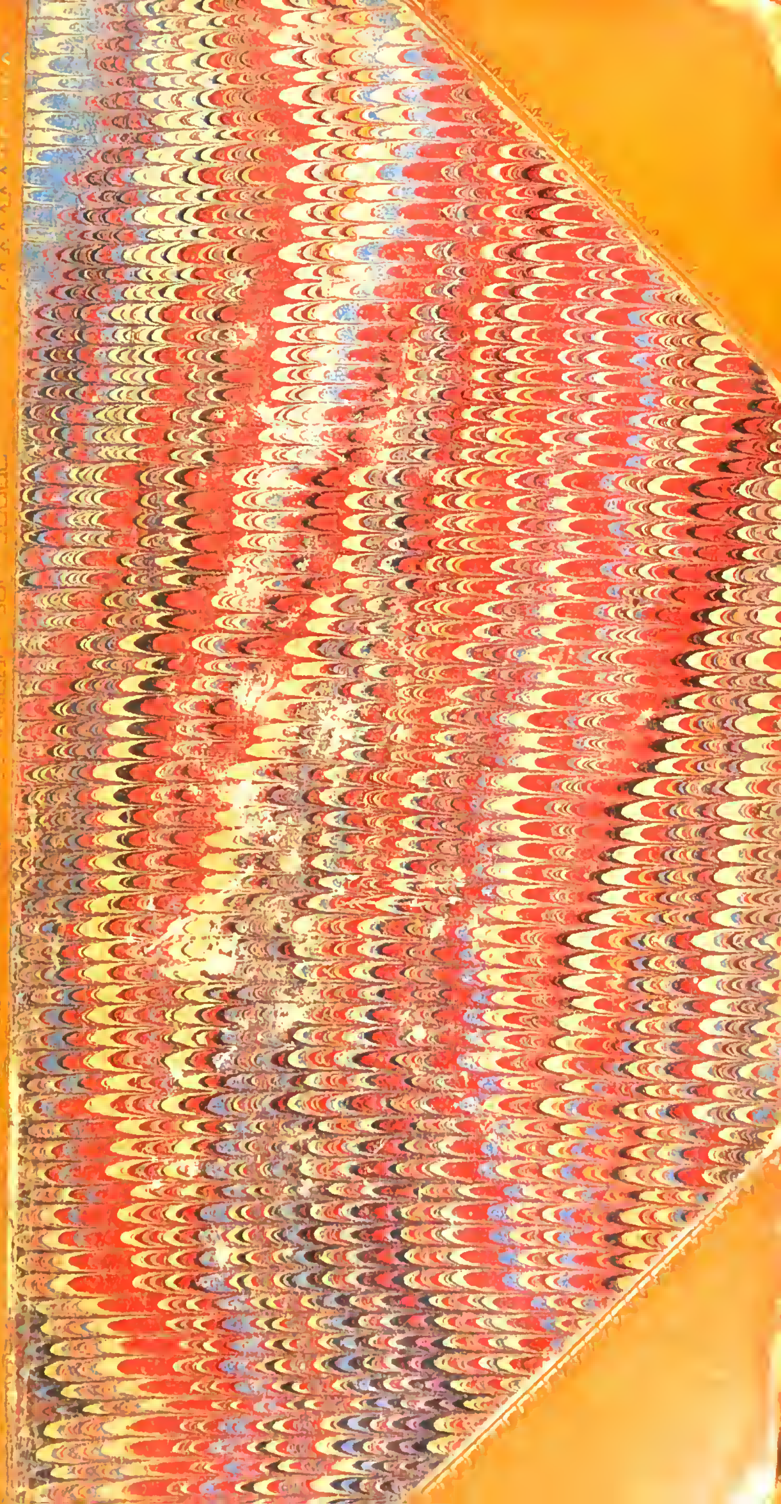

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MEDICAL JURISPRUDENCE.

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MEDICAL JURISPRUDENCE.

BY

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Qui nescit ignorare ignorat scire.

SEVENTH EDITION.

LONDON:
JOHN CHURCHILL, NEW BURLINGTON STREET.
MDCCCLXI.

PREFACE

TO

THE SEVENTH EDITION.

In preparing for publication, the seventh edition of the Medical Jurisprudence, I have not found it necessary to make any extensive changes. Some articles have been abridged in order to make room for more recent information, but the general plan of the work has been retained. Since its first appearance in the year 1844, there have issued from the press fifteen thousand seven hundred and fifty copies. I regard this as a satisfactory proof of its practical utility to those members of the Medical and Legal professions, for whose assistance it has been especially intended. This unexpected encouragement has induced me to spare no labour in order to maintain the work on a level with the progress of medical and legal knowledge. Every chapter has undergone a close revision, and many new cases and observations have been added. I have retained the numerous additions and revisions made by the late Lord Justice Clerk Hope, as well as by many legal and medical contributors, who have kindly supplied me with facts in correction or confirmation of the views already published.

I cannot close this Preface without publicly thanking the Royal College of Physicians, and the Society of Arts for the honour conferred on this work in awarding to the author in January 1860, under the will of the late Dr. Swiney, the quinquennial prize of one hundred pounds, and a silver vase of like value.

15, St. James's Terrace, Regent's Park.
June, 1861.

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MEDICAL JURISPRUDENCE.

POISONING.

CHAPTER 1.

MEDICAL DEFINITION OF THE TERM POISON—LEGAL DEFINITION—ADMINISTERING OF POISON—DEADLY POISONS—MECHANICAL IRRITANTS—INFLUENCE OF HABIT AND IDIOSYNCRASY ON POISONS—CLASSIFICATION OF POISONS—SPECIAL CHARACTERS OF IRRITANT, CORROSIVE, AND NEUROTIC POISONS.

Definition. — A POISON is commonly defined to be a substance, which, when administered *in small quantity*, is capable of acting deleteriously on the body; and in popular language, this term is applied to those substances only which destroy life in small doses. It is obvious that this definition is too restricted for the purposes of medical jurisprudence. It would, if admitted, exclude numerous substances, the poisonous properties of which cannot be disputed—as, for example, the salts of copper, tin, zinc, lead, and antimony; these, generally speaking, act only as poisons when administered in large doses. Some substances, such as nitre, have not been known to act as poisons except when taken in large quantity, while arsenic acts as a poison in small doses; but in a medico-legal view, whether a man dies from the effects of half an ounce of nitre, or two grains of arsenic, the responsibility of the person who criminally administers the substance is the same. Each may be regarded as a poison, differing from the other only in its degree of activity, and in its mode of operation. The result is the same; death is caused by the substance taken, and the *quantity* required to kill cannot therefore be made a ground for distinguishing a poisonous from a non-poisonous substance. If, then, a medical witness be asked "What is a poison?" he must beware of adopting this popular definition, or of confining the term poison to a substance which is capable of operating as such in a small dose given at once.

In legal medicine, it is difficult to give such a definition of a poison as shall be entirely free from objection. Perhaps the most comprehensive which can be suggested is this:—"A poison is a substance which, when taken into the stomach or bowels, is capable of destroying life without acting mechanically on the system." But it is well known that some substances act as poisons by absorption when applied either to the skin or to a wounded surface; while others, again, as the poison of the viper, and of rabies, may have their fatal effects limited to those cases in which they are introduced by a wound: and a third class may destroy life merely by their chemical effects upon the parts with which they come in contact, without necessarily poisoning the blood by *absorption; e. g.* sulphuric acid. These facts show that it is not possible to comprise in a few words an accurate definition of what should be understood by the term "poison."

It is equally difficult to define the boundary between a medicine and a poison. It is usually considered that a medicine in a large dose is a poison, and a poison in a small dose is a medicine; but a medicine such as tartarized antimony may be easily converted into a poison, by giving it in small doses at short intervals either under states of the body not adapted to receive it, or in cases in which it exerts an injuriously depressing effect. Several deaths have been lately occasioned by this wilful misuse of antimony in doses which might be described as *medicinal*, although in the cases referred to, no other intention could have existed in the secret administration of this substance than that of destroying life. A person may die either from a large dose given at once, or from a number of small doses given at such intervals that the system cannot recover from the effects of one before another is administered. This remark applies to a great number of medicines which are not commonly included in a list of poisons.

Legal Definition.—In reference to the *medical* definition of a poison, it is necessary to observe that the law never regards the manner in which the substance administered acts. If it be capable of destroying life or of injuring health, it is of little importance so far as the responsibility of a prisoner is concerned, whether its action on the body be of a mechanical or chemical nature. Thus a substance which simply acts mechanically on the stomach or bowels may, if wilfully administered with intent to injure, involve a person in a criminal charge, as much as if he had administered arsenic or any of the ordinary poisons. It is, then, necessary that we should consider what the law strictly means by the act of poisoning. If the substance criminally administered destroy life, whatever may be its nature or mode of operation, the accused is tried on a charge of murder or manslaughter, and the duty of a medical witness consists in showing that the substance taken was the certain cause of death. If, however, death be not a consequence, then the accused may be tried for the attempt to murder by poison (1 Vict. c. 85, sec. 2). The words of this statute are general, and embrace all kinds of substances, whether they are popularly or professionally regarded as poisons or not. Thus it is laid down that—

"Whoever shall administer, or cause to be taken by any person, any poison, or other destructive thing, with intent to commit murder, shall be guilty of felony, and being convicted thereof shall suffer death."

Although the administering be followed not by death but only by bodily injury dangerous to life, it is still a capital felony, provided the *intent* has been to commit murder. The *attempt* to administer to any person, any *poison* or other destructive thing, with the like intent, &c., although no bodily injury be effected, is felony, punishable by transportation for life, for fifteen years, or imprisonment for any term not exceeding three years. From the words of the statute it appears that the law requires, in order to constitute the crime of poisoning, that the substance should be *administered to*, or be *taken by*, an individual. Several deaths have been caused of late years by the external application of arsenic and corrosive sublimate to ulcerated and diseased surfaces. Supposing that a poison is thus applied intentionally, and great bodily injury is done to an individual, it might be a question whether the crime could be punished under these sections of the statute. Lord Campbell's Act (14 and 15 Vict. c. 19) appears to provide for this description of offence, although the application or administration is herein limited to chloroform, laudanum, or other stupefying drugs. The external application of arsenic in a way to produce personal injury would no doubt be considered an act of administration.

Poison is not always administered with intent to murder. On many occasions it has been mixed with food, and thus administered with a view to injure or annoy a person. Cantharides have been thus frequently given, and in one instance (Nov. 1859) eight members of a family suffered from severe symptoms of poisoning by reason of the wanton administration of this drug. In April 1860, several members of a family suffered from severe sickness, as a result of tobacco having been put into water contained in a teakettle; and tartar emetic has been in some cases dissolved in beer or other liquids as a mere frolic, without any proved or probable intention on the part of the offender to destroy life. The case of *M'Mullen* (Liverpool Autumn Assizes, 1856), revealed an extensive system of poisoning in the northern counties, in which tartar emetic was the substance employed. This drug, mixed with cream of tartar, was openly sold by druggists under the name of "quietness powders," and the evidence established that women gave these powders to their husbands with a view to cure them of habits of drunkenness. Hitherto, when the intent to murder was not proved, the offender has escaped, although great bodily injury may have been done by his wanton or malicious act. To supply this omission, an Act has been passed (23 Vict. c. 8, March 23, 1860), of which the provisions are here subjoined. It enacts:—

"1. That whosoever shall unlawfully and maliciously administer to, or cause to be administered to or taken by any other person, any poison or other destructive or noxious thing so as thereby to endanger the life of such person, or so as thereby to inflict upon such person any grievous bodily harm, shall be guilty of felony, and being convicted thereof shall be liable to be sentenced to penal servitude for any period not exceeding ten years and not less than three years, or to imprisonment for any term not more than three years, with or without hard labour, at the discretion of the Court.

"2. Whosoever shall unlawfully and maliciously administer to, or cause to be administered to or taken by any other person, any poison or other destructive or noxious thing with intent to injure, aggrieve, or annoy such person, shall be guilty of a misdemeanor, and being convicted thereof shall be liable to be sentenced to imprisonment for any period not exceeding three years, with or without hard labour, at the discretion of the Court, and the costs and expenses of the prosecution of any such misdemeanor may be allowed by the Court as in cases of felony.

"3. If, upon the trial of any person charged with the felony above mentioned, the jury shall not be satisfied that such person is guilty thereof, but shall be satisfied that he is guilty of the misdemeanor above mentioned, then and in every such case the jury may acquit the accused of such felony, and find him guilty of such misdemeanor, and thereupon the delinquent shall be liable to be punished in the same manner as if convicted upon an indictment for the misdemeanor."

It will be perceived that the words of the statutes leave the question "what is a poison" to depend upon the medical evidence adduced. It must, however, be proved that the substance is either a poison or a noxious or destructive thing. In a trial which took place at the Essex Lent Assizes, 1850 (*Reg.* v. *Hayward*), a woman was charged with administering *white precipitate* to her husband with intent to kill. She was acquitted on the ground that there was no evidence to show that white precipitate was either a poison or a destructive thing. It is, however, placed beyond doubt that this substance is not only capable of producing all the effects of an irritant poison, but of destroying human life: hence, this acquittal was based on a pure mistake. *White hellebore*, *Lobelia inflata*, and *Oil of tur-*

pentine have been erroneously pronounced not to be poisons under similar circumstances; in fact, unless the medical evidence received by a Court when this question is raised, be very closely investigated, the greatest mistakes may arise, owing perhaps to want of experience or want of reflection on the part of those to whom the question is put.

The quantity of a poisonous substance found in an article of food, or in a dead body, does not affect the culpability of a person indicted for administering it. In the case of *Hartley* (C.C C. May 12, 1850), in which an attempt was made to administer sulphuric acid mixed with coffee, Cresswell J. stated—if poison be administered with intent to murder, it is not necessary there should be enough in the article administered to cause death. If any poison be there, and the intent be proved, the crime of attempting to administer poison is complete. Erle J. ruled to the same effect, in reference to the discovery of a small quantity of arsenic in a dead body, in *Reg.* v. *Bacon* (Lincoln Summer Assizes, 1857). In *Reg.* v. *Southgate* (Chelmsford Lent Assizes, 1849), Parke B. said, in reply to an objection taken, it was quite immaterial to define or prove in what vehicle a poison was given, or whether it was administered in a solid or liquid form.

This question, " What is a poison ? " may present itself under another aspect. In the *Queen* v. *Cluderay* (Exchequer Chamber, January 19, 1849), the prisoner was indicted for administering poison with intent to murder. He was proved to have administered to a child nine weeks old, two berries in the husk, of *Cocculus Indicus*, and the berries passed through the body of the child without doing any injury. It was submitted for the prisoner, that being in the husk they could not be considered a poison. The point was reserved by Williams J., who tried the case at York. It was now contended for the prisoner, that although the kernel of this nut was poisonous, still having been given in the husk, which was hard of digestion, it could not be considered an administering of poison within the statute 1 Vict. c. 85. The Chief Justice said the Court was of opinion that, when a man administered something that was poison with intent to murder, but in such a way that it did not act, he was guilty. Conviction affirmed. This is the only reasonable view to take of such an objection. The seed contains the poison, but the husk is inert: nevertheless the berry must be regarded as a poison.

Deadly poison.—The term "deadly" can be applied with propriety only to those poisons which may prove speedily fatal in small doses—*e. g.*, prussic acid, arsenic, strychnia, aconitina, and nicotina; and although it has been used in indictments in reference to such substances as blue or green vitriol, and common sal volatile, this has arisen from an unnecessarily strict adherence to old legal forms. In a case (*Reg.* v. *Haydon*, Somerset Spring Assizes, 1845), in which "spirit of hartshorn" was thus described as a "deadly poison," and an objection was taken to the validity of the indictment, the learned judge (Erle J.) held that the word *deadly* was not essential: it was mere surplusage (Law Times, April 12, 1845). This decision is in accordance with common sense.

Mechanical irritants.—The substance administered may not be a poison in the medical signification of the term, and it may not be popularly considered as such; yet, when taken, it may be destructive to life. We have examples of substances of this description in iron-filings, powdered glass, sponge, pins and needles, and such like bodies, all of which have been administered with the wilful design of injuring, and have on various occasions given rise to criminal charges. In cases of this kind, the legal guilt of a prisoner may often depend on the meaning assigned by a medical witness to the words *destructive thing.* Thus, to take an example, liquid mercury might be poured down the throat of an infant, with the deliberate intention to destroy it. A question of a purely medical nature will then arise whether mercury be "a destructive thing" or not; and the conviction of a prisoner will probably depend on the answer. Should a difference of opinion exist,—an occurrence by no means unusual in medical evidence,—the prisoner will, according to the humane principle of our law, receive the benefit of the doubt.

Influence of Habit on Poisons.—Habit, it is well known, diminishes the effect of certain poisons:—thus it is that opium, when frequently taken by a person, loses its effect after a time, and requires to be administered in a much larger dose. Indeed, confirmed opium-eaters have been enabled to take at once, a quantity of the drug which would have infallibly killed them, had they commenced with it in the first instance. Even infants and young children, who are well known to be especially susceptible of the effects of opium, and are liable to be poisoned by very small doses, may, by the influence of habit, be brought to take the drug in very large quantities. This is well illustrated by a statement made by Mr. Grainger, in the Report of the Children's Employment Commission. It appears that the system of drugging children with opium in the factory districts, commences as soon after birth as possible: and the dose is gradually increased until the child takes from fifteen to twenty drops of laudanum at once! This has the effect of throwing it into a lethargic stupor. Healthy children of the same age would be killed by a dose of five drops. The same influence of habit is manifested more or less in the use of tobacco, alcohol, ether, chloroform, morphia, strychnia, and other alkaloids. Dr. Christison has remarked that this influence is chiefly confined to poisons derived from the organic kingdom: and I quite agree with him in thinking that the stories related of the arsenic-eaters of Styria, and the corrosive sublimate-eaters of Turkey, are not to be credited. There is no satisfactory proof that any human being has ever accustomed himself, by habit, to take these substances in doses that would prove poisonous to the generality of adults. I have only met with one fact which appears adverse to this opinion. M. Flandin states that he gave to animals doses of arsenious acid in powder, commencing with 1-65th of a grain mixed with their food; and that in nine months, by progressive increase, they bore a dose of upwards of fifteen grains of arsenious acid in powder in twenty-four hours, without becoming affected in appetite or health! (Traité des Poisons, vol. 1. p. 737.) This is contrary to all experience in the medicinal use of arsenic in the human subject; for, as it will be seen hereafter, a slight increase of a medicinal dose has often been attended with such alarming symptoms, as to render a discontinuance of the medicine absolutely necessary to the safety of the person. The only form in which I have known the question of habit to be raised in medical jurisprudence is this: whether, while the more prominent effects of a poison are thereby diminished, the insidious or latent effects on the constitution are at the same time counteracted. The answer is of some importance in relation to the subject of life insurance:—for the concealment of the practice of opium-eating by an insured party has already given rise to an action, in which medical evidence on this subject was rendered necessary. As a general principle, we must admit that habit cannot altogether counteract these insidious effects of poisons: but that the practice of taking them is liable to give rise to disease or to impair the constitution.

Influence of Idiosyncrasy.—Idiosyncrasy differs from habit:—it does not, like habit, diminish the effect of a poison: for it is not commonly found that any particular state of body is a safeguard against the effects of these powerful agents. Some constitutions are observed to be much more affected than others by certain poisons:—thus opium, arsenic, mercury, lead, and antimony are substances of this description, and this difference in their effects is ascribed to idiosyncrasy. Dr. Christison mentions a remarkable instance, in which a gentleman unaccustomed to the use of opium, took nearly an ounce of good laudanum without any effect. (On Poisons, 33.) This form of idiosyncrasy is very rare. Certain substances generally reputed harmless, and, indeed, used as articles of food, are observed to affect some persons like poisons. This is the case with pork, certain kinds of shell-fish, and mushrooms. There may be nothing poisonous in the food itself; but it acts as a poison in particular constitutions;—whether from its being in these cases a poison *per se*, or rendered so by changes during the process of digestion, it is difficult to say. The subject of idiosyncrasy is of importance in a medico-legal view when symptoms resembling those of poisoning follow a meal consisting of a particular kind of food. In such a case, without a knowledge of this peculiar condition, we might hastily attribute to poison, effects which were really due to another cause. It would appear that in some instances idiosyncrasy may be acquired—*i. e* , a person who, at one period of his life, had been in the habit of partaking of a particular kind of food without injury, may find at another period that it will disagree with him. When pork has been disused as an article of diet for many years, it cannot always be resumed with impunity. In cases in which the powers of life have become enfeebled by age, the susceptibility of the system to poisons is increased; thus aged persons may be killed by comparatively small doses of arsenic and opium. Cases of acquired idiosyncrasy are very rare: it appears to be, if we may so apply the term, a congenital condition. There are, however, certain diseases which appear to confer a power of supporting large and even poisonous doses of some substances. Very large doses of opium have been taken without producing dangerous symptoms by persons labouring under tetanus and hydrophobia. This condition is called *tolerance*. It has been witnessed in diseases of the lungs in reference to the use of antimonial medicines.

CLASSIFICATION OF POISONS.—Poisons have been divided into three classes, according to their mode of action on the system: namely, IRRITANTS, NARCOTICS, and NARCOTICO-IRRITANTS. This classification is a modification of that originally proposed by Orfila.

The Narcotics and Narcotico-irritants may, however, be regarded as constituting one large class, the NEUROTICS, as their special action is to affect directly one or more parts of the nervous system. The neurotic poisons admit of a subdivision into Cerebral, Spinal, and Cerebro-spinal, according to whether the poisonous substance affects directly the brain, the spinal marrow, or both of these organs.

IRRITANTS.—The irritants are possessed of these common characters. When taken in ordinary doses, they occasion speedily violent vomiting and purging. These symptoms are either accompanied or followed by pain in the stomach and bowels. The peculiar effects of the poison are manifested chiefly on these organs, which, as their name implies, they irritate and inflame. Many substances belonging to this class of poisons possess corrosive properties: such as the strong mineral acids, caustic alkalies, bromine, corrosive sublimate, and others. These, in the act of swallowing, are commonly accompanied by an acrid or burning taste, extending from the mouth down the gullet to the stomach. Some irritants do not possess any corrosive action,—of which we have examples in arsenic, the poisonous salts of baryta, carbonate of lead, and cantharides; these are often called pure irritants. They exert no destructive chemical action on the tissues with which they come in contact; they simply irritate and inflame them.

Difference between Corrosive and Irritant Poisons.—As a result of the action of *corrosive* poisons, symptoms are commonly manifested immediately, because mere contact produces the destruction of a part. In the action of the purely *irritant* poisons, the symptoms are generally more slowly manifested, rarely showing themselves until at least half an hour has elapsed from the time of swallowing the substance. Of course, there are exceptions to this remark; for sometimes irritants act speedily, though rarely with the rapidity of corrosive poisons. It is important in a practical view, to ascertain whether, in an unknown case, the poison which a person, requiring immediate treatment, may have swallowed, be irritant or corrosive. This may be commonly determined by a knowledge of the time at which the symptoms appeared after the suspected poison was taken. We may thus often easily distinguish between a case of poisoning from arsenic and one from corrosive sublimate. There is also another point which may be noticed. As the corrosive substance exerts a decidedly chemical action, an examination of the mouth and throat may enable us in some cases to solve the question.

It has been already stated that there are many irritant poisons which have no corrosive properties, but every corrosive may act as an irritant. Thus the action of corrosive sublimate is that of an irritant poison, as, while it destroys some parts of the coats of the stomach and intestines, it irritates and inflames others. So again most corrosive poisons may lose their corrosive properties by dilution with water, and then they act simply as irritants. This is the case with the mineral acids, and bromine. In some instances, it is not easy to say whether an irritant poison possesses corrosive properties or not. Thus oxalic acid acts immediately, and blanches and softens the mucous membrane of the mouth and throat, but I have not met with any decided marks of chemical corrosion produced by it in the stomach or viscera. Irritant poisons, for the most part, belong to the mineral kingdom; and they may be divided into the *Non-metallic* and *Metallic* irritants. There are a few derived from the animal and vegetable kingdom; but these are not often employed criminally. Some of the gases likewise belong to the class of irritant poisons.

NEUROTICS.—Neurotic poisons act upon the nervous system, and their operation is confined chiefly to the brain and spinal marrow. Either immediately or some time after the poison has been swallowed, the patient suffers from head-ache, giddiness, numbness, paralysis, stupor, and in some instances convulsions. They have no acrid burning taste like the corrosive irritants; and they very rarely give rise to vomiting or purging. When these symptoms follow the ingestion of the poison into the stomach, the effect may be generally ascribed either to the form or quantity in which the poison has been taken, and the mechanical effect on the stomach thereby produced, or to the poison being combined with some irritating substance, such as alcohol. The pure *narcotics*, or *Cerebral poisons*, are not found to irritate or inflame the stomach and bowels.

Notwithstanding the well defined boundary thus apparently existing between these two classes of poisons, it must not be supposed that the substances arranged in each class always act in the manner indicated. Some irritants have been observed to affect the brain or the spinal marrow, and this may be either a primary or a secondary consequence of their action. Arsenic and oxalic acid, although classed as irritants, have in some instances given rise to symptoms closely resembling those of narcotic poisoning; namely, coma, paralysis, and tetanic convulsions. In a case of poisoning by arsenic, which occurred to Dr. Morehead, of Bombay, the symptoms of narcotism were so strongly marked, that it was believed at first the man had taken a narcotic. (Med. Gaz. vol. 43. p. 1055.) I have met with a case of poisoning by arsenic in which there was paralysis of the limbs, with an entire absence of purging, during the eight days that the deceased survived. On the other hand, in a case of poisoning by a large dose of opium, there was an absence of the usual symptoms of cerebral disturbance, and the presence of others resembling those of irritant poisoning—namely, pain and vomiting. Thus, then, we must not allow ourselves to be misled by the idea that the symptoms are always clearly indicative of the kind of poison taken. The narcotic or cerebral poisons are few in number, and belong to the vegetable kingdom. Some of the poisonous gases possess a narcotic action.

Narcotico-Irritants. (*Spinal and Cerebro-spinal Poisons.*)—Poisons belonging to this class have, as the name implies, a compound action. They are chiefly derived from the vegetable kingdom. At variable periods after they have been swallowed they give rise to vomiting and purging, like irritants: and sooner or later produce stupor, coma, paralysis and convulsions, owing to their effects on the brain and spinal marrow. In the state of vegetables, as leaves, seeds, or root, they possess the property, like irritants, of irritating and inflaming the stomach and bowels. As familiar examples we may point to nux vomica, monkshood, hemlock, and poisonous mushrooms. This class of poisons is very numerous, embracing a large variety of well-known vegetable substances; but they rarely form a subject of difficulty to a medical practitioner. The fact of the symptoms occurring after a meal at which some suspicious vegetables may have been eaten, coupled with the nature of the symptoms themselves, will commonly indicate the class to which the poison belongs. Some of these poisons have a hot acrid taste; others, like aconite or monkshood, produce a sense of numbness or tingling, while others again have an intensely bitter taste, as nux vomica, strychnia, veratria, and picrotoxia. Strychnia may be regarded as a pure spinal poison.

CHAPTER 2.

EVIDENCE OF POISONING IN THE LIVING SUBJECT—SYMPTOMS OCCUR SUDDENLY — MODIFYING CONDITIONS — ACTION OF POISONS INCREASED OR DIMINISHED BY DISEASE—SYMPTOMS CONNECTED WITH FOOD OR MEDICINE — SUDDEN DEATH FROM NATURAL CAUSES MISTAKEN FOR POISONING—SEVERAL PERSONS ATTACKED SIMULTANEOUSLY — EVIDENCE FROM THE DETECTION OF POISON IN THE FOOD.

We now proceed to consider the evidence of poisoning in the *living* subject. To the practitioner the diagnosis of a case of poisoning is of great importance, as by mistaking the symptoms produced by a poison for those arising from natural disease, he may omit to employ the remedial measures which have been found efficacious in counteracting its effects, and thus lead to the certain death of the patient. To a medical jurist a correct knowledge of the symptoms furnishes the chief evidence of poisoning, in those cases in which persons are charged with the malicious and unlawful administration of poison. The symptoms produced during life, constitute also an important part of the evidence in those instances in which a poison proves fatal. At present, however, we will suppose the case to be that poison has been taken and the patient survives. Most toxicological writers have laid down certain characters whereby it is said symptoms of poisoning may be distinguished from those of disease.

1. *In poisoning, the symptoms appear suddenly, while the individual is in health.*—It is the common character of most poisons, when taken in the large doses in which they are usually administered with criminal intent, to produce serious symptoms, either immediately or within a very short period after they have been swallowed. Their operation, under such circumstances, cannot be suspended, and then manifest itself after an indefinite interval; although this was formerly a matter of universal belief, and gave rise to many absurd accounts of what was termed *slow* poisoning.

The symptoms of poisoning by nicotina, prussic acid, oxalic acid, or the salts of strychnia, appear immediately, or generally within a very few minutes after the poison has been swallowed. In one case, in which the dose of prussic acid was small, and insufficient to produce death, the poison was supposed by the patient not to have begun to act until after the lapse of fifteen minutes. (Ed. Med. and Surg. Journ. vol. 59. p. 72.) The symptoms caused by arsenic and other irritants, and, indeed, by all poisons generally, are commonly manifested in from half an hour to an hour. It is rare that the appearance of symptoms is protracted for two hours, except under certain peculiar states of the system. It is said that some neurotic poisons, such as the poisonous mushrooms, may remain in the stomach twelve or twenty-four hours without giving rise to symptoms; and this is also affirmed to be the case with some animal irritants, such as decayed meat; but with regard to the first point, it has been shown by Dr. Peddie that mushrooms have produced symptoms in half an hour; and a case has fallen under my own observation, in which the symptoms from noxious animal food came on within as short a time after the meal as is commonly observed in irritant poisoning by mineral substances. In some cases of poisoning by phosphorus, no symptoms have been observed until after the lapse of some hours.

Modifying conditions. Influence of disease.—A *diseased* state of the body may render a person comparatively unsusceptible of the action of certain poisons, while in other instances it may increase their action, and render them fatal in small doses. In dysentery and tetanus a person will take, without being materially affected, a quantity of opium sufficient to kill an adult in average health. In mania, cholera, hysteria, and delirium tremens, large doses of opium may be borne with comparative impunity. In a case of hemiplegia, a woman æt. 29, took for six days three grains of strychnia daily without injurious consequences—the dose having been gradually raised (Gaz. Med. Mai 1845); while one grain of strychnia is commonly regarded as a fatal dose to a healthy person. In a case of tetanus, Dupuytren gave as much as two ounces of opium at a dose (60 grammes), without serious consequences. (Flandin, Traité des Poisons, vol. 1. p. 231.) It has also been remarked that persons affected with tetanus are not easily salivated by mercury. The morbid state appears to create the power of resisting the ordinary effects of poisons. (Colles's Lectures, vol. 1. p. 77.) The effect of certain diseases of the nervous system, as well as of habit, either in retarding the appearance of symptoms or in blunting the operation of a poison, it is not difficult to appreciate: they are cases which can present no practical difficulty to a medical jurist. On the other hand, in certain diseased states of the system, there may be an increased susceptibility of the action of poison. Thus, in those persons who have a disposition to apoplexy, a small dose of opium may act more quickly and prove fatal. In a person labouring under inflammation of the stomach or bowels, there would be an increased susceptibility of the action of arsenic, antimony, or other irritants. One of the most remarkable instances of the influence of disease in increasing the operation of poison, is perhaps seen in cases of diseased kidney (granular degeneration), in which very small doses of mercury have been observed to produce severe salivation, leading to exhaustion and death. A knowledge of this fact is of importance in reference to charges of malapraxis, when death has arisen from ordinary doses of calomel administered to persons labouring under this disease.

Symptoms appear during a state of health.—Symptoms of poisoning often manifest themselves in a person while in a state of *perfect health*, without any apparent cause. This rule is of course open to numerous exceptions, because the person on whose life the attempt is made may be actually labouring under disease; and under these circumstances the symptoms may be so obscure as often to disarm all suspicion. When poison is exhibited in medicine, a practitioner is very liable to be deceived, especially if the disease under which the person is labouring be of an acute nature, and attended by symptoms of disorder in the alimentary canal. Several cases of poisoning have occurred in which arsenic was criminally substituted for medicine, and given to the parties while labouring under a disorder of the bowels. We are, however, justified in saying, with respect to this character of poisoning, that when in a previously healthy person violent vomiting and purging occur suddenly and without any assignable cause, such as pregnancy, disease, or indiscretion in diet, to account for them, there is strong reason to suspect that irritant poison has been taken. When the person is already labouring under disease, we must be especially watchful on the occurrence of any sudden change in the character or violence of the symptoms, unless such change can be easily accounted for on common or well-known medical principles. In most cases of criminal poisoning we meet with alarming symptoms without any obvious or sufficient natural causes to explain them. The practitioner will of course be aware that there are certain diseases which are liable to occur suddenly in healthy people, the exact cause of which may not at first sight be apparent; therefore this criterion is only one out of many on which a medical opinion should be founded.

2. *In poisoning the symptoms appear soon after a meal, or soon after some kind of food or medicine has been taken.*—This is by far the most important character of poisoning in the living body. It has been already stated that most poisons begin to operate within about an hour after they have been swallowed;

and although there are a few exceptions to this remark, yet they occur under circumstances easily to be appreciated by a practitioner. Thus, then, it follows that, supposing the symptoms under which a person is labouring to depend on poison, the substance has most probably been swallowed, either in food or medicine, from half an hour to an hour previously. It must be observed, however, that cases of poisoning may occur without the poison being introduced by the mouth. Oil of vitriol and other corrosive liquids have been thrown up the rectum in injections, and have thus caused death; the external application of arsenic, corrosive sublimate, and cantharides to ulcerated surfaces has destroyed life. In one case arsenic was introduced into the vagina of a female, and she died in five days under all the symptoms of arsenical poisoning. (Schneider, Ann. der ges. Staatsarzneikunde, i. 229.) Such cases are rare, but, nevertheless, the certainty that they have occurred, where their occurrence could hardly have been anticipated, shows that in a suspicious case a practitioner should not deny the fact of poisoning merely because it is proved that the person could not have taken the poison in the usual way—by the mouth. Again, persons may be destroyed by the vapours of ether, chloroform, prussic acid, or other powerful volatile poisons, introduced into the body through the lungs. Such a mode of suicide, or murder, might disarm suspicion, from the fact of no noxious material being found in the stomach. An Act of Parliament has been passed, which makes it felony to administer, or even to attempt to administer, poisons in this manner (14 and 15 Vict. c. 19, sec. 3).

Let us suppose, however, the circumstances to have been such that these secret means of destruction could not have been resorted to, and that the poison is one of those most commonly selected by a murderer, such as arsenic, tartar emetic, oxalic acid, or corrosive sublimate, then we may expect that this character of poisoning will be made evident to us, and that something must have been *swallowed* by the patient shortly before the alarming symptoms appeared. By observations attentively made, it may be in our power to connect the appearance of the symptoms with the use of a particular article of food, and thus indirectly lead to the detection of a criminal. Supposing that many hours have passed since food or medicine was taken by the patient, without any effect ensuing,—it is probable that the symptoms are due to natural causes and not to poison. When symptoms resembling those of poisoning speedily follow the ingestion of food or medicine, there is, however, reasonable ground for suspicion: but caution should be observed in drawing inferences, since the most extraordinary coincidences sometimes present themselves. In the case of *Sir Theodosius Boughton*, who was poisoned by his brother-in-law, Donellan.

in 1781, the fact of alarming symptoms coming on in *two minutes* after the deceased had swallowed what was supposed to be a simple medicinal draught, was a most important fact in the evidence against the prisoner. There is no doubt that laurel-water had been substituted for the medicine by the prisoner, and that this had caused the symptoms which preceded death. The practice of substituting poisonous mixtures for medicinal draughts or powders is by no means unusual, although it might be supposed to indicate a degree of refinement and knowledge not commonly to be found among criminals. Medical practitioners are thus apt to be imposed upon, and the following case, related by a deceased judge, will serve as a caution:—An apothecary prepared a draught, into which another person put poison, intending thereby to destroy the life of the patient for whom the medicine was prescribed. The patient, not liking the taste of the draught, and thinking there was something suspicious about it, sent it back to the apothecary, who, knowing the ingredients of which he had composed it, and wishing to prove to his patient that he had done nothing wrong, drank it himself, and died from the effects. He was thus the unconscious agent of his own death; and although the draught was intended for another, the party who poisoned it was held guilty of murder. This case contains a serious warning to medical witnesses. It is not unusual, on trials for poisoning, when the poison is conveyed through medicine, to find a medical witness offering to swallow his own draught in a Court of Law, in order to furnish a convincing practical illustration of the innocence of the medicine! It need hardly be observed that an exhibition of this kind is never required of a medical witness. If any doubt be raised of the innocent properties of a draught or powder, a chemical analysis of its contents will be far more satisfactory, and attended with no kind of risk to the practitioner.

On the other hand, the occurrence of symptoms resembling those produced by poisoning, soon after food or medicine has been taken, may be a pure coincidence. In such a case, poison is always suspected by the vulgar; and it will be the duty of a medical jurist to guard against the encouragement of such a suspicion, until he has strong grounds to believe it to be well founded. No public retractation or apology can ever make amends for the injury which may in this way be inflicted on the reputation of another; for they who hear the accusation may never hear the defence. In all such cases, a practitioner may entertain a suspicion, but, until confirmed by facts, he should avoid *expressing* it, or giving it publicity. When death is not a consequence, it is difficult to clear up such cases, except by the aid of a chemical analysis; but this, as we know, is not always applicable. If death ensue, the real cause is usually apparent, and a suspicion of poisoning is thus often removed by an examination of the body.

3. *In poisoning, when several partake at the same time of the same food or medicine (mixed with poison) all suffer from similar symptoms.*—This character of poisoning cannot always be procured; but it furnishes good evidence of the fact when it exists. Thus, supposing that after a meal made by several persons from the same dish, only one suffers, the suspicion of poisoning is considerably weakened. The poisoned article of food may be detected by observing whether they who suffer under any symptom of poisoning, have partaken of one particular solid or liquid in common. In a case of accidental poisoning at a dinner-party, a medical man who was present observed that those who suffered had taken port wine only: the contents of the bottle were examined, and found to be a saturated solution of arsenic in wine. In general, considerable reliance may be placed upon this character, because it is very improbable that any common cause of disease should suddenly attack with violent and alarming symptoms many healthy persons at the same time, and within a short period after having partaken of food together. We must beware of supposing that, in those cases in which poison is really present, all will be attacked with precisely similar symptoms; because, as we have seen, there are many circumstances which may modify their nature and progress. In general that person who has partaken most freely of the poisoned dish will suffer most severely; but even this does not always follow. There is a well-known case, recorded by Bonnet, where, among several persons who partook of a dish poisoned with arsenic, they who had eaten little and *did not vomit* speedily died; while others who had partaken largely of the dish, and had in consequence vomited freely, recovered.

It was just now remarked, that there is no disease likely to attack several healthy persons at the same time, and in the same manner. This is undoubtedly true as a general principle, but the following case will show that mistakes may occasionally arise even under these circumstances. It occurred in London, during the prevalence of the malignant cholera in the year 1832. Four of the members of a family, living in a state of great domestic unhappiness, sat down to dinner in apparently good health: some time after the meal, the father, mother, and daughter, were suddenly seized with violent vomiting and purging. The stools were tinged with blood, while the blueness of the skin, observed in cases of malignant cholera, was wanting. Two of these persons died. The son, who was known to have borne ill-will against his father and mother, and who suffered no symptoms on this occasion, was accused of having poisoned them. At the inquest, however, it was clearly shown by the medical attendant, that the deceased persons had really died of malignant cholera, and there was no reason to suspect that any poison had been administered to them. In this instance it will be perceived that symptoms resembling those of irritant poison appeared suddenly in several individuals in perfect health, and shortly after a meal. We hereby learn that the utility of any rules for investigating cases of poisoning depends entirely on the judgment and discretion with which they are applied to particular cases.

It is well to bear in mind, in conducting these inquiries, that symptoms resembling those produced by irritant poison may be sometimes due to the description of *food* which may have been taken at the meal. Besides flesh rendered unwholesome from disease and decay, there are certain kinds of shell-fish, as well as pork, bacon, sausages, cheese and bread, which, under certain circumstances, may give rise to formidable symptoms, and even death. Such cases may be regarded as poisoning by animal or vegetable irritants. All the characters above described, as indicative of poisoning, may be observed, and the difficulty of forming an opinion is often increased by the fact that some of the persons attacked may have previously partaken of the same kind of food without inconvenience.

4. *The discovery of poison in the food taken, or in the matters vomited.*—One of the strongest proofs of poisoning in the living subject, is the detection of poison by chemical analysis, or, if of a vegetable nature, by a microscopical examination, either in the food taken by the person labouring under its effects, or in the matters vomited, or, after a few hours, in the urine. The evidence is of course more satisfactory when the poison is detected in the matters vomited or in the urine, than in the food; because this will show that it has really been taken, and will readily account for the symptoms. If the vomited matters have been thrown away, we must examine the food of which the patient may have partaken. Should the results in both cases be negative, and no trace of poison be found in the urine, it is probable that the symptoms were due to disease.

In investigating a case of poisoning in the living subject, a medical jurist must remember, that poisoning is sometimes *feigned* and at others, *imputed*. It is very easy for an artful person to put poison into food, as well as to introduce it into the matters vomited or discharged from the bowels, and to accuse another of having administered it. There are few of these accusers who go so far as to swallow poison under such circumstances, as there is a great dread of poisonous substances among this class of criminals; and it will be at once apparent, that it would require a person well versed in toxicology, to feign a series of symptoms which would impose upon a practitioner at all acquainted with the subject. In short, the difficulty reduces itself to this:—What inference can be drawn from a chemical detection of poison in food? All that a medical man can say is, whether poison is or is not present in a particular article of food:—he must leave it to the authorities of the law to develope the alleged attempt at administration. If the poison has been actually administered or taken, then we should expect to find the usual symptoms. The absence of these symptoms would be a strong fact against the alleged administration. The detection of poison in the matters vomited, affords no decisive proof that it has been swallowed, except under two circumstances:—1. When the accuser has previously laboured under the usual symptoms of poisoning, in which case there can be no feigning, and the question of imputation is a matter to be established by general evidence. 2. When the matters are actually vomited into a *clean vessel* in the presence of the medical attendant himself, or of some person on whose testimony perfect reliance can be placed. The detection of poison in the *urine* furnishes a clear proof that poison has been taken, that it has passed into the blood, and has been subsequently eliminated.

CHAPTER 3.

ON THE EVIDENCE OF POISONING IN THE DEAD BODY—PERIOD AT WHICH POISONS PROVE FATAL.—CHRONIC POISONING—APPEARANCES PRODUCED BY THE DIFFERENT CLASSES OF POISONS — REDNESS OF THE MUCOUS MEMBRANE MISTAKEN FOR INFLAMMATION—ULCERATION AND CORROSION—SOFTENING — PERFORATION OF THE STOMACH FROM POISON AND DISEASE.

Supposing that the person is dead, and we are required to determine whether the case is one of poisoning or not, we must, in the first instance, endeavour to ascertain all the particulars which have been considered in the last chapter, as indicative of poisoning in the living subject. Should the deceased have died from poison, the circumstances of the attack, and the symptoms preceding death, ought to correspond with the characters already described: and in these investigations it is well to bear in mind the following rule:—There is no one symptom or pathological condition which is peculiar to poisoning: but at the same time there is probably no disease which presents *all* those characters which are met with in a special case of poisoning. The additional evidence to be derived from the *death* of the person, may be considered under the following heads:—

1. *The time at which death takes place after the first occur-*

rence of symptoms. — This question requires examination, because the more common poisons, when taken in fatal doses, generally cause death within definite periods of time. By an attention to this point we may, in some instances, be enabled to negative a charge of poisoning, and in others to form an opinion of the kind of poison which has been taken. In a Court of Law a medical practitioner is often required to state the usual *period of time* within which poisons prove fatal. It is to be observed that, not only do poisons differ from each other in this respect, but the same substance, according to the form or quantity in which it has been taken, may differ in the rapidity of its action. A large dose of prussic acid, *i.e.*, from half an ounce to an ounce, may destroy life in less than two minutes. In ordinary cases of poisoning by this substance a person dies, *i. e.* all signs of life have commonly ceased, in from ten to twenty minutes :—if he survives half an hour there is some hope of recovery. In the cases of the seven Parisian epileptics, accidentally poisoned by this acid, the first died in about twenty minutes, the seventh survived three quarters of an hour. Oxalic acid, one of the most energetic of the common poisons, when taken in a dose of from half an ounce to an ounce, may destroy life in from ten minutes to an hour: if the poison be not perfectly dissolved when swallowed, it is a longer time in proving fatal. The strong mineral acids, in poisonous doses, destroy life in about eighteen or twenty-four hours. Arsenic, under the form of arsenious acid (white arsenic), operates fatally in from eighteen hours to three or four days. It has, however, in more than one instance killed a person in two hours; although this is by no means common. Opium, either as a solid or under the form of laudanum, commonly proves fatal in from six to twelve hours; but it has been known, in several instances, to destroy life in less than three hours: they who survive the effects of this poison for twelve hours are considered to have a fair chance of recovery. This must be understood to be merely a statement of the average results, as nearly as we are warranted in giving an opinion; but the medical jurist will of course be aware that the fatal period may be protracted or shortened, according to all those circumstances which have been elsewhere stated to affect the action of poisons.

There are various forms which this question may assume in a Court of Law :—the death of a party, alleged to have taken poison, may have occurred too rapidly or too slowly to justify a suspicion of poisoning. The following case may serve as an illustration :—A woman of the name of *Russell* was tried and convicted at the Lewes Summer Assizes, in 1826, for the murder of her husband, by poisoning him with arsenic. The poison was detected in the stomach; but the fact of poisoning was disputed by some medical witnesses, for this among other reasons—that the deceased had died *three* hours after the only meal at which the poison could have been administered to him. The authority of Sir A. Cooper and others was cited to show that, according to their experience, they had never known a case to have proved fatal in less than seven hours. This may have been; but, at the same time, there was sufficient authority on the other side to establish that some cases of arsenical poisoning had actually proved fatal in three or four hours. So far as this objection was concerned, the prisoner was very properly convicted. In reference to the medical question raised at this trial, I may observe that within a recent period two distinct cases have occurred in which the individuals died certainly within *two hours* after taking arsenic: and several instances have been reported since the trial, in which death took place in from three to four hours after the administration of this poison. It seems extraordinary in the present day that any attempt should have been made by a professional man to negative a charge of criminal poisoning upon so weak a ground as this; but we must remember that this opinion was expressed many years ago, when the facts connected with poisoning were but little known. It is quite obvious that there is nothing, so far as we know, to prevent arsenic from destroying life in an hour, or even in a shorter period than that. A case will be hereafter related, in which death took place from arsenic most probably within twenty minutes. These matters can be settled only by a careful observation of numerous cases, and not by any *à priori* reasoning, or a limited individual experience.

In all instances of sudden death there is generally a strong tendency on the part of the vulgar to suspect poisoning. They never can be brought to consider that persons may die a natural death *suddenly*, as well as slowly; or, as we shall presently see, that death may really take place slowly, as in cases of disease, and yet be due to poison. This prejudice continually gives rise to the most unfounded suspicions of poisoning, and, at the same time, leads to cases of chronic or slow poisoning being frequently mistaken for disease. One of the means recommended for distinguishing narcotic poisoning from apoplexy or disease of the heart, is the difference in the rapidity with which death takes place. Thus, apoplexy or disease of the heart may prove fatal either instantly or within an hour. The only poisons likely to operate with such fatal rapidity are prussic acid or nicotina. Poisoning by opium is commonly protracted for five or six hours. This poison has never been known to destroy life instantaneously, or in a few minutes. Thus, then, it may happen that death will occur with such rapidity as to render it impossible, under the circumstances, to attribute it to narcotic poison.

Chronic poisoning.—When a poison destroys life rapidly, it is called a case of *acute* poisoning, to distinguish it from the *chronic* form, *i.e.* in which death takes place slowly. Chronic poisoning is a subject which has of late frequently required medico-legal investigation. Most poisons, when their effects are not rapidly manifested, owing either to the smallness of the dose or to timely treatment, are capable of slowly undermining the powers of life, and killing the patient by producing emaciation and exhaustion. This is sometimes observed in the action of arsenic, corrosive sublimate, and tartarized antimony, but it has been remarked also in cases of poisoning by the mineral acids and caustic alkalies. Death is here an indirect consequence;—in poisoning by the acids or alkalies, either stricture of the gullet is induced, or the lining membrane of the stomach is destroyed, and the process of digestion impaired,—a condition which leads to emaciation and death. The time at which these indirect effects may prove fatal, is of course liable to vary. A person has been known to die from a stricture of the gullet, brought on by sulphuric acid, *eleven months* after the poison was swallowed; and there is no reason to doubt that instances may occur of a still more protracted nature. In cases of *chronic poisoning* there is sometimes great difficulty in assigning death exclusively to the original action of the poison, since the habits of life of the party—a tendency to disease, and other circumstances—may have concurred either to accelerate or produce a fatal result. To connect a stricture of the gullet proving fatal with the effects of poisoning by a mineral acid, it would be necessary to show that there was no tendency to this disease before the acid was administered:—that the symptoms appeared soon after the first effects of the poison went off:—that these symptoms continued to become aggravated until the time of death—and that there was no other cause to which death could with any probability be referred. These remarks apply equally to the secondary fatal effects of any poison,—such, for instance, as the salivation occasionally induced by corrosive sublimate, and the exhaustion and depression produced by tartarized antimony, when the acute symptoms of poisoning by these substances have passed away.

Several cases have come before our tribunals, in which the facts connected with this form of poisoning were of some importance. I allude to those of *Miss Blandy*, tried at Oxford, in 1752, for the murder of her father by arsenic; and of a woman named *Butterfield*, tried at Croydon, in 1775, for the murder of a Mr. Scawen, by administering corrosive sublimate. Among cases of recent occurrence, may be mentioned that of Mrs. Wooler (*Reg.* v. *Wooler*, Durham Winter Assizes, 1855), in which it was clearly proved that the deceased had been under the influence of arsenic, administered at intervals in repeated doses, for a period of about seven weeks before her death. She died from exhaustion and the secondary effects of the poison. In three other cases tartarized antimony was the poison selected. It was given in repeated doses, over different periods, and caused death, by the specific effects of poisoning in a chronic form. 1. The case of *Ann Palmer* (Guy's Hospital Reports, October, 1857). 2. The case of *M'Mullen* (Liverpool Summer Assizes, 1856), in which a woman was tried and convicted for causing the death of her husband; and 3rd, the case of *Reg.* v. *Hardman* (Lancaster Summer Assizes, 1857), in which a man was convicted of the murder of his wife. In most cases, murderers destroy life by administering poison in very large doses; but in the instances referred to, small doses were given at intervals,—a fact which, in some of them, led to a medical doubt of the real cause of the symptoms. The case of *Isabella Banks* (*Reg.* v. *Smethurst*, Central Criminal Court, August, 1859) gave rise to a conflict of medical opinion respecting the cause of death. Drs. Julius and Bird, who attended the deceased throughout her illness of about a month's duration, the late Dr. Todd, and myself, referred the symptoms and cause of death to chronic poisoning by antimony and arsenic, and in confirmation of this opinion antimony was distinctly found by Dr. Odling and myself in the intestines after death. Arsenic was also found in an evacuation passed by the deceased three days before her death. Dr. Tyler Smith, Dr. Richardson, and others, who did not see the deceased, ignoring the existence of antimony in the body, referred the symptoms and appearances partly to pregnancy and partly to a sudden attack of severe dysentery. The jury found the accused guilty, but upon the doubt thus raised in the public mind respecting the cause of death, the accused was subsequently discharged. A similar question arose in *Reg.* v. *Winslow* (Liverpool Autumn Assizes, 1860). The prisoner was charged with the murder of a Mrs. James by administering to her small doses of antimony. The suspicions of Dr. Cameron, who attended deceased, were excited by the intermittent and violent nature of the vomiting as well as the extreme depression. Antimony was found in the urine and fæces by Dr. Edwards: and after death this substance was discovered, in very small quantity, in the viscera, by Dr. Edwards, Dr. Miller, and myself. The deceased was at the time labouring under malignant disease of the cæcum, but it was alleged that the antimony had accelerated her death. The jury acquitted the accused. The examination of the bodies of the sister of deceased, as well as of two other members of the family, led to the discovery of antimony also in small quantity, in the viscera of each, and from the nature of the symptoms preceding death, as well as the general healthiness of the organs, no doubt was entertained by the medical witnesses that all these persons—members of the same household—had died from the effects of antimony administered at intervals in small doses. The law could not fix the perpetration of these four murders upon any individual, and three would have wholly escaped public notice, but for the death of Mrs. James some months after the bodies of the others had been buried under medical certificates setting forth natural causes of death! The occurrence of such cases as these suggests grave reflections on the insecurity of life, when poison is used with skill and cunning, and on the inefficiency of the present system of registering causes of death. The editor of the Law Magazine has truly said, in commenting upon the Smethurst case, "All that is requisite for future murderers by poison to do, is to use small doses, combine the use of various destructive drugs, and subpœna the proper witnesses. If the judge and jury should, nevertheless, be convinced that the skilful poisoner was guilty, it is then open to him to work the papers and 'public opinion,' get other doctors' evidence, and apply to the Home Office." (The Trial of Thomas Smethurst, Law Magazine, Nov. 1859, p. 145.) That this will be the course pursued by future poisoners is highly probable: hence the characters of chronic poisoning have acquired a special interest for the medical jurist. There is, however, a difficulty about these cases which no accuracy of observation or judgment can surmount. The poison or poisons, if found in the dead body at all, must necessarily exist in fractional parts of a grain. This alone will be sufficient to create a doubt whether death has been caused by the poison—although it is quite consistent with medical experience that a person may die from chronic poisoning, and little or none of the poison be found in the body after death. In the case of Mrs. James (*Reg.* v. *Winslow*), not more than the tenth part of a grain was found in the whole of the tissues of the body: in the case of Isabella Banks (*Reg.* v. *Smethurst*), the quantity was greater than this, but less than a grain altogether; while in the case of *Mrs. Peters*, of Yeovil, examined by Mr. Herapath, *none* was found in the body, although this chemist had extracted a quantity of antimony as sulphide from the urine of deceased in less than nine days before death! In this case Dr. Garland had also found antimony in the evacuations during life, and had referred the intermittent irritation of the stomach and bowels, from which the deceased had suffered, to the secret use of this mineral. The jury returned a verdict that deceased had died from disease, and that her death was accelerated by some irritant. (Lancet, Aug. 4th, 1860, p. 119.) It has been, of late years, a contested scientific question, whether a person can die from poison and no trace of the poison remain in the body. Mr. Herapath's evidence in Mrs. Peters' case not only proves the affirmative, but goes to show that antimony may act fatally and be entirely eliminated from the system in about a week. (Med. Times and Gaz., Aug. 25, Sept. 15, and 29, 1860, pp. 190, 271, 317.)

2. *Evidence from appearances in the body.* — One of the chief means of determining whether a person has died from poison, is an examination of the body after death. In relation to *external* appearances, there are none indicative of poisoning upon which we can safely rely. It was formerly supposed that the bodies of persons who were poisoned, putrefied more rapidly than those of others who had died from natural disease; and evidence for or against poisoning was at one time derived from the external appearance of the body. This is now known to be an error: the bodies of persons poisoned are not more rapidly decomposed, *cæteris paribus*, than those of others who have died a sudden and violent death from any cause whatever.

Irritant poisons act chiefly upon the stomach and intestines, which they irritate, inflame, and corrode. We may likewise meet with all the consequences of inflammation, such as ulceration, perforation, and gangrene. Sometimes the coats of the viscera are thickened, at other times thinned and softened by the action of an irritant.

Neurotic (*Cerebral and Spinal*) poisons do not commonly leave any well-marked appearances in the body. The stomach and intestines present no unnatural changes. There may be greater or less fulness of the vessels of the brain and spinal marrow and of their membranes; but even this is often so slight as to escape notice, unless attention be particularly directed to these organs. Effusion of blood is rarely found.

The *Narcotico-irritant* or *Cerebro-spinal* poisons may affect either the brain or the stomach and bowels, and commonly all these parts according to their peculiar mode of action.

It is important to bear in mind, that both Irritants and Neurotics may destroy life without leaving any appreciable changes in the body. To such cases as these, the remarks about to be made do not apply. The proofs of poisoning must, then, be procured entirely from other sources. Any evidence derivable from the appearances in the body of a person poisoned, will be imperfect unless we are able to distinguish them from those analogous changes often met with as the results of ordinary disease. These are confined to the mucous membrane of the stomach and bowels. They are redness, ulceration, softening, and perforation. Each of these conditions may depend upon disease, as well as upon the action of irritant poisons.

Redness. — It is a main character of the irritants to produce as a result of inflammation redness of the mucous or lining membrane of the stomach and small intestines. This redness, when first seen, is usually of a deep crimson colour, becoming brighter by exposure to air. It may be diffused over the whole mucous membrane: at other times it is seen in patches, dots, or lines (striæ), spread irregularly over the surface of the stomach. It is sometimes met with at the smaller, but more commonly at the larger end of this organ, and again we occasionally find that the folds or prominences only of the mucous membrane present this red or inflamed appearance. Redness of the mucous membrane may, however, be due to gastritis or gastro-enteritis as a result of disease; and in order to assign the true cause of the inflammation, it will be necessary to have an account of the symptoms preceding death, or some chemical proof of the existence of irritant poison in the contents of the stomach or in the tissues of the body.

In the healthy state, the mucous membrane of the stomach is pale and white, or nearly so, except during digestion, when it is slightly reddened; and some observers have remarked that a slight redness has often remained in the stomachs of those who have died during the performance of the digestive process. When in contact with the spleen or liver, after death, the stomach is apt to acquire a deep livid colour from the transudation of blood; and it is well known that the bowels acquire a somewhat similar colour from the gravitation of blood which always takes place after death. None of these appearances are likely to be mistaken for the action of an irritant poison.

There is an important class of cases in which redness of the mucous membrane of the stomach is found after death, not dependent on the action of poison or on any easily assignable cause. These cases, owing to their being so little known, and involved in much obscurity, deserve the attention of the medical jurist, since the appearances closely resemble those produced by irritant poison. A person may die without suffering from any symptoms of disordered stomach; but on an inspection of the body, a general redness of the mucous membrane of this organ will be found, not distinguishable from the redness which is so commonly seen in arsenical poisoning. Several cases of this kind have occurred at Guy's Hospital: and drawings have been made of the appearance presented by the stomach, and are preserved in the Museum collection.

The redness of the stomach, in cases of poisoning, is so speedily altered by putrefaction, when circumstances are favourable to this process, as frequently to render it impossible for a witness to speak with any certainty upon its cause. Putrefactive infiltration from the blood contained in the adjacent viscera and muscles, will give a reddish-coloured appearance to a stomach otherwise in a healthy condition. Great dispute has arisen respecting the length of time during which redness of the stomach produced by an irritant will be recognizable and easily distinguishable from putrefactive changes. It is sufficient to say, that no certain rule can be laid down on the subject: it must be left to the knowledge and discretion of the witness. I have distinctly seen the well-marked appearances of inflammation produced by arsenic in the stomach and duodenum in an exhumed body twenty-eight days after interment (*Reg.* v. *Jennings*, Berks Lent Ass. 1845); and in another instance, referred to me by Mr. Lewis, the coroner for Essex, in August 1846, the reddened state of the mucous membrane, in a case of arsenical poisoning, was plainly perceptible on removing a layer of arsenic, *nineteen months* after interment. (See, on this question, a case of suspected poisoning by Orfila, Annales d'Hyg. 1839, vol. 1. p. 127.) If, however, there should be a reasonable doubt respecting the cause of the redness, it would be unsafe to rely upon this appearance as evidence of poisoning, unless poison were detected.

Ulceration.—In irritant poisoning, the stomach is occasionally found ulcerated: but this is, comparatively speaking, a rare occurrence. In such cases the mucous membrane is removed in small distinct circular patches, under the edges of which the poison (arsenic) may be found. Ulceration of the stomach is a more common result of disease, than of the action of poison. As a consequence of disease, it is very insidious, going on often for weeks together, without giving any indications of its existence, except perhaps slight gastric disturbance, with occasional nausea, vomiting, and loss of appetite. In this case the ulceration is commonly seen in small circumscribed patches. It is worthy of remark, as a means of distinction, that ulceration has never been known to take place from arsenic or any irritant poison, until symptoms indicative of irritant poisoning have occurred. In ulceration from disease, the mucous membrane is commonly only reddened in the neighbourhood of the ulcer. In ulceration from poison, the redness is generally diffused over other parts of the stomach, as well as over the duodenum and small intestines. A case, however, occurred in Guy's Hospital, some years ago, in which, with a small circular patch of ulceration near the cardiac opening, the whole mucous membrane was red and injected: but this singular condition of the stomach, so closely resembling the effects of an irritant poison, was unaccompanied by any marked symptoms of irritation during life. The history of a case previous to death will thus commonly enable us to determine, to what cause the ulceration found, may be due. Care must be taken to distinguish ulceration from *corrosion*. Ulceration is a vital process: the substance of a part is removed by the absorbents as a simple result of inflammation. Corrosion, on the other hand, is a chemical action;—the parts are removed by the immediate contact of the poison: they are decomposed: their vitality is destroyed, and they combine with the corrosive matter itself. Ulceration requires time for its establishment, while corrosion is either an instantaneous or a very rapid effect.

Softening.—The coats of the stomach are not unfrequently found so soft as to yield and break down under very slight pressure; and this may be the result either of poisoning, of some spontaneous morbid change in its structure during life, or of the solvent action of the gastric juice after death. As this condition of the stomach, when caused by poison, is commonly produced by those substances only which possess corrosive properties, it follows that in such cases traces of their action will be perceived in the mouth, throat, and gullet. In softening from disease, the change will be confined to the stomach alone, and it is commonly found only at the cardiac or greater end of the organ. When softening is really caused by an irritant poison, it is generally attended by other striking and unambiguous marks of its operation. Softening is not to be regarded as a common character of poisoning: it is only an occasional appearance. I have met with a case in which the coats of the stomach were considerably hardened by sulphuric acid. Softening can never be inferred to have proceeded from poison, unless other well-marked changes are present, or unless the poison is discovered in the softened parts. The stomachs of infants have been frequently found softened from natural causes:—such cases could not be mistaken for poisoning, since the history during life, the want of other appearances indicative of poisoning, and the total absence of poison from the viscera, would prevent such a suspicion from being entertained.

Perforation.—The stomach may become perforated, either as a result of poisoning or disease.

Perforation from poisoning.—This may arise:—1, from corrosion; 2, from ulceration. The perforation by *corrosion* is by far the most common variety of perforation from poisoning. It is occasionally witnessed when the strong mineral acids have been taken, especially sulphuric acid:—the stomach, in such cases, is blackened and extensively destroyed,—the aperture is large, the edges are rough and irregular, and the coats are easily lacerated. The acid escapes into the abdomen, and may be readily detected there by chemical analysis. The perforation from *ulceration*, caused by irritant poison (arsenic), is but little known. There are but few instances on record. In a great number of poisoned subjects examined during many years past at Guy's Hospital, not a single case has occurred. It must, then, be looked upon as a rare appearance in cases of irritant poisoning.

Perforation from disease.—This is by no means an unusual condition. Many cases of this disease will be found reported elsewhere. (Guy's Hosp. Rep. No. 8.) It is invariably fatal when it proceeds so far that the contents of the stomach escape into the abdomen; but sometimes the stomach becomes glued to the pancreas during the ulcerative process, and then the person may recover. Several instances of this kind of adhesion have been met with in inspections. The symptoms from perforation commonly attack a person suddenly, apparently while enjoying perfect health. Hence these cases may be easily mistaken for those of irritant poisoning. The principal facts observed with regard to this formidable disease are the following:—1. It often attacks young females from eighteen to twenty-three years of age. 2. The preceding illness is extremely slight; sometimes there is merely loss of appetite, or a capricious appetite, with uneasiness after eating. 3. The attack commences with a sudden and most severe pain in the abdomen, generally soon after a meal. In irritant poisoning the pain usually comes on gradually, and slowly increases in severity. 4. Vomiting, if it exist at all, is commonly slight, and is chiefly confined to what is swallowed. There is no purging:—the bowels are generally constipated. In irritant poisoning the vomiting is usually severe, and purging seldom absent. 5. The person dies commonly in from eighteen to thirty-six hours:—this is also the average period of death in the most common form of irritant poisoning, *i.e.* by arsenic;—but in no case yet recorded has arsenic caused perforation of the stomach within twenty-four hours; and it appears probable that a considerable time must elapse before such an effect could be produced by this or any irritant. 6. In perforation from disease, the symptoms and death are clearly referable to peritonitis. 7. In the perforation from disease, the aperture is commonly of an oval or rounded form, about half an inch in diameter, situated in or near the lesser curvature of the stomach, and the edges are smooth. The outer margin of the aperture is often blackened, and the aperture itself is funnel-shaped from within outwards, *i.e.* the mucous coat is the most removed, and the outer or peritoneal coat, the least. The coats of the stomach, round the edge of the aperture, are usually thickened for some distance: and when cut they have almost a cartilaginous hardness. These characters of the aperture will not alone indicate whether it is the result of poisoning or disease: but the absence of poison from the stomach, with the want of other characteristic marks of irritant poisoning, would enable us to say that disease was the cause. Besides, the history of the case during life would materially assist us in our judgment. The great risk in all these cases is, that the effects of disease may be mistaken for those of poisoning: for we are not likely to mistake a perforation caused by irritant poison for the result of disease. Notwithstanding the well-marked differences above described, it is very common to meet with cases of imputed poisoning where death has really occurred from peritonitis following perforation. I have been required to examine several cases of this kind: one of them will be found elsewhere recorded (Guy's Hosp. Reports, Oct. 1850, page 226). In another the body was exhumed after several months' burial, and the stomach was found perforated from disease in the usual situation.

Spontaneous or Gelatinized Perforation.—The stomach is occasionally subject to a spontaneous change, by which its coats become softened and give way generally at the cardiac or greater end. As the effusion of the contents of the organ in such a case never gives rise to peritoneal inflammation, and no symptoms occur prior to death to indicate the existence of so extensive a destruction of parts, it is presumed to be a change in the dead body, and the coats of the stomach are supposed to undergo a process of solution or digestion. It is commonly attributed to the solvent action of the gastric juice,—the spleen, diaphragm, and other viscera being sometimes softened. (For remarks on this subject by Dr. Budd, see Med. Gaz. vol. 39. p. 895.) In January, 1845, I met with an instance of this perforation in a child between two and three years of age. It was seized with convulsions, became insensible, and died twenty-three hours afterwards. After death, the greater end of the stomach was found destroyed to the extent of three inches; and the edges were softened and blackened. There was no food in the stomach, and nothing had passed into the organ for thirty-two hours before death! It was therefore impossible to ascribe death to the perforation, or the perforation to poison. (For a full account of this case, see Med. Gaz. vol. 36. p. 32.) An inspection of the body, with a general history of the case, will commonly suffice to remove any doubt in forming an opinion whether the extensive destruction so commonly met with, has or has not arisen from poison. Thus, in a cadaveric perforation, the aperture is always situated in that part of the stomach which lies to the left of the cardia; it is very large, of an irregular form, and ragged and pulpy at the edges which have the appearance of being scraped. The mucous membrane of the stomach is not found inflamed. There is occasionally slight redness, with dark brown or almost black lines (striæ) in and near the dissolved coats, which have an acid reaction. It can only be confounded with perforation by the action of corrosives; but the well-marked symptoms during life, and the detection of the poison after death, together with the changes in the throat and gullet, will at once indicate the perforation produced by corrosive poison. A case of extensive perforation of the stomach, as the result of the action of the gastric fluids, has been reported by Dr. Barnes. (See Med. Gaz. vol. 41. p. 293.)

CHAPTER 4.

RULES TO BE OBSERVED IN INVESTIGATING A CASE OF POISONING — WITH RESPECT TO THE PATIENT WHILE LIVING — THE INSPECTION OF THE BODY — THE EXHUMATION OF BODIES — DISPOSAL OF THE VISCERA — IDENTITY OF SUBSTANCES — PRESERVATION OF ARTICLES FOR ANALYSIS — ON THE USE OF NOTES — WHEN ALLOWED TO BE USED IN EVIDENCE — MEDICO-LEGAL REPORTS.

When a practitioner is called to a case of poisoning, it is above all things necessary that he should know to what points he ought to give his attention. It is very proper that every effort should be made by him to save life when the individual is living: but while engaged in one duty, it is also in his power to perform another, supposing the case to be one of suspected criminal poisoning, — namely, to note down many circumstances which may tend to detect the perpetrator of a crime. There is no person so well fitted to observe these points as a medical man; but it unfortunately happens, that many facts important as evidence are often overlooked. The necessity for observing and recording them is not perhaps generally known. A medical man need not make himself officious on such occasions, but he would be sadly unmindful of his duty as a member of society, if he did not aid the course of justice by extending his scientific knowledge to the detection of crime. It is much to the credit of the medical profession, that the crime of murder by poisoning—a form of death from which no caution or foresight can protect an individual, is so frequently brought to light, by the announcement of suspicious facts of a medical nature to magistrates and coroners: and on several occasions the highest compliments have been passed by judges, on medical practitioners who have been thus indirectly the means of bringing an atrocious criminal to the bar of justice.

The following appear to me to be the principal points which demand the attention of a medical jurist in all cases of suspected poisoning:—1. With respect to

Symptoms.

1. The time of their occurrence.—their nature. 2. The exact period at which they were observed to take place after a meal, or after food or medicine had been taken. 3. The order of their occurrence. 4. Whether there was any remission or intermission in their progress, or, whether they continued to become more and more aggravated until death. 5. Whether the patient had laboured under any previous illness. 6. Whether

the symptoms were observed to recur more violently after a particular meal, or after any particular kind of food or medicine. 7. Whether the patient has vomited :—the vomited matters, if any (especially those *first* ejected), should be procured : their odour, colour, and acid or alkaline reaction noted, as well as their quantity. 8. If none be procurable, and the vomiting has taken place on the dress, furniture, or floor of a room,—then a portion of the clothing, sheet, or carpet, may be cut out and reserved for analysis ;—if the vomiting has occurred on a deal floor, a portion of the wood may be scraped or cut out :—or if on a stone pavement, then a clean piece of sponge soaked in distilled water, may be used to remove any traces of the substance. [Some years since, an animal was poisoned by arsenic. None of the poison could be detected in the stomach, but it was easily found in a portion of deal floor, rendered humid by the liquid matters which the animal had vomited during the night.] The vessel in which vomited matters have been contained will often furnish valuable evidence, since heavy mineral poisons fall to the bottom, or adhere to the sides of the vessel. 9. Endeavour to ascertain the probable nature of the food or medicine last taken, and the exact *time* at which it was taken. 10. Ascertain the nature of *all* the different articles of food used at a meal. 11. Any suspected articles of food, as well as the vomited matters, should be sealed up as soon as possible in a clean glass vessel, labelled, and reserved for analysis. 12. Note down, in their own words, all explanations voluntarily made by parties present, or who are supposed to be concerned in the suspected poisoning. 13. Whether more than one person partook of the food or medicine :—if so, whether all these persons were affected, and how ? 14. Whether the same kind of food or medicine had been taken before by the patient or other persons without ill effects following. In the event of the *death* of the patient, it will be necessary for the practitioner to note down—15. The *exact time* of death, and thus determine how long a period the person has survived after having been first attacked with the suspicious symptoms. 16. Observe the attitude and position of the body. 17. Observe the state of the dress. 18. Observe all surrounding objects. Any bottles, paper packets, weapons, or spilled liquids lying about, should be collected and preserved. 19. Collect any vomited matters near the deceased. Observe whether vomiting has taken place in the recumbent position or not. If the person has vomited in the erect or sitting posture, the front of the dress will commonly be found covered with the vomited matters.

INSPECTION OF THE BODY.

20. Note the external appearance of the body, whether the surface is livid or pallid. 21. Note the state of the countenance. 22. Note all marks of violence on the person, or discomposure of the dress,—marks of blood, &c. 23. Observe the presence or absence of warmth or coldness in the legs, arms, abdomen, mouth, or armpits. 24. The presence of rigidity or cadaveric spasm in the body. To give any value to the two last-mentioned characters, it is necessary for the practitioner to observe the nature of the floor on which the body is lying,—whether the body be clothed or naked, young or old, fat or emaciated. These conditions create a difference, in respect to the cooling of the body and the access of rigidity. 25. If found dead—When was the deceased last seen living, or known to have been alive? 26. Note all circumstances leading to a suspicion of suicide or murder. 27. The time after death at which the inspection is made. 28. Observe the state of the abdominal viscera. If the stomach and intestines be found inflamed, the seat of inflammation should be exactly specified; also all marks of softening, ulceration, effusion of blood, corrosion, or perforation. The stomach should be removed and placed in a *separate vessel*, ligatures being applied to the two ends. If cut open for examination at this period, this should be performed in a clean dish and with such care, that none of the contents are lost or are allowed to mix with the contents of the intestines. 29. The contents of the stomach, if this organ is opened during the inspection, should be collected in a clean *graduated* vessel:—notice *a* the quantity, *b* the odour tried by several persons, *c* the colour, *d* acid or alkaline reaction; *e* presence of blood, mucus, or bile; *f* presence of undigested food; and here it may be as well to observe, that the presence of farinaceous matters, (bread) would be indicated by the addition of iodine water, if the contents were not alkaline—of fat, by heat; *g* other special characters. 30. The contents of the duodenum should be separately collected, ligatures being applied to it. 31. Observe the state of the large intestines, especially the rectum, and note the condition of their contents. The discovery of hardened fæces in the rectum would prove that purging had not existed recently before death. In one case which I was required to examine, this became a question of considerable importance. 32. The state of the windpipe, throat, and gullet,—whether there are in these parts any foreign substances, or marks of inflammation and corrosion. This is of essential importance, as it throws a light upon the question, whether the poison swallowed was irritant or corrosive, and whether it had or had not a local chemical action. It also re-

moves any doubt which might arise respecting death by suffocation from mechanical causes. 33. The state of the lungs and heart; all morbid changes noted. 34. The state of the brain and spinal marrow. 35. The condition of the uterus, ovaries, and genital organs should be examined, as, in the female, poison has been sometimes introduced into the system by the vagina. 36. The liver with the gall bladder should be removed for a chemical examination. 37. The urinary bladder, with any fluid contained in it, should be removed and placed in a separate jar.

Such are the points to which, in the greater number of cases of suspected poisoning, a medical jurist should attend. By means of these data, noted according to the particular case to which they are adapted, he will in general be enabled, without difficulty, to determine the probable time of death, and the actual means by which death was brought about. He may thereby have it in his power also to point out the dish or article of food which had contained the poison, if the case be one of poisoning; and to throw light upon any disputed question of suicide or murder in relation to the deceased. Many cases of poisoning are rendered obscure, owing to these points not having been attended to in the first instance.

I have not considered it necessary to enter into any details respecting the mode of performing an *inspection*. This the practitioner will have acquired during his study of anatomy: and the only essential points in addition to those mentioned, are—1. To examine all the important organs for marks of natural disease: and 2. To note down any unusual pathological appearances, or abnormal deviations; although they may at the time appear to have no bearing on the question of poisoning. It is useful to bear in mind on these occasions, that the body is inspected, not merely to show that the individual has died from poison, but to prove that he has *not* died from any *natural cause*. Medical practitioners commonly give their attention exclusively to the first point; while lawyers, who defend accused parties, very properly direct a most searching examination to the last-mentioned point, *i. e.* the healthy or unhealthy state of those organs which are essential to life, and with which the poison has not probably come in contact. The usual causes of *sudden death* have their seat commonly in the brain, the heart and its great vessels, or in the lungs. Marks of effusion of blood, congestion, inflammation, suppuration, or a diseased condition of the valves of the heart, should be sought for and accurately noted, whatever may be the condition of the abdominal viscera. It has also been recommended that an examination of the spinal marrow should be made. If the cause of death be obscure after the general examination of the body, there is good reason for inspecting the condition of this organ.

Exhumation of bodies.—Sometimes the inspection of a body is required to be made long after interment. So long as the coffin remains entire, there may be the expectation of discovering certain kinds of mineral poison in the organs; but decomposition may have advanced so far as to destroy all pathological evidence. The inspection in such cases is commonly confined to the abdominal viscera. The stomach is often found so thinned and collapsed, that the anterior and posterior walls appear to form only one coat. This organ should be removed, with the duodenum, and ligatures applied to each. The liver and the spleen should also be removed in order that they may, if necessary, be separately analyzed. If poison is not found in one or more of these viscera, it is not likely that it will be discovered in the body. It has been recommended that a portion of earth immediately above and below the coffin should be removed for analysis, as it may contain arsenic: but this appears to me to be an unnecessary piece of refinement when the coffin is entire, or when the abdominal parietes still cover the viscera. If decomposition has so far advanced as to have led to an admixture of earth with the viscera, and the poison is found in minute quantity in the tissues only, the source of the poison may be regarded as doubtful. In giving a positive opinion upon such hyperchemical views, it might be fairly objected that traces of arsenic always exist in the iron and brass nails and ornaments which are used in a coffin: and this arsenic is just as likely to furnish a valid objection to medico-legal researches as that which is said to be a constituent of all soils in which oxide of iron abounds. The body of a deceased person, when exhumed, should be identified by some friend or relative, in the presence of the medical examiner. In one case of murder by poison the evidence almost failed, owing to this precaution not having been taken.

It is important that the viscera taken from a body which has been long in the grave should be sealed up immediately. They should not be allowed to come in contact with any metal, nor with any surface except that of clean glass, porcelain, or wood. It has been recommended that they should be washed with chloride of lime, or placed in alcohol; but this is decidedly improper: the use of any preservative chemical liquid would not only embarrass the future analysis, but would render a special examination of an unused portion of the liquid necessary—the identity of which would have to be unequivocally established. Preservation from air in clean glass vessels, with well-fitted corks, covered with skin, or, what is still better, sheet-caoutchouc, is all that is required in practice. There is no objection to the use of a small quantity of chloroform. The vapour of this liquid is diffused through the vessel and tends to retard putrefaction.

IDENTITY OF SUBSTANCES.

It is necessary to observe, that all legal authorities rigorously insist upon proof being adduced of the *identity* of the vomited matters or other liquids taken from the body of a deceased person, when poisoning is suspected. Supposing that during the examination, the stomach and viscera are removed from the body, they should never be placed on any surface, or in any vessel, until we have first ascertained that the surface or vessel is perfectly *clean*. If this point be not attended to, it will be in the power of counsel for the defence to raise a doubt in the minds of the jury, whether the poisonous substance might not have been accidentally present in the vessel used. This may be regarded as a very remote presumption; but, nevertheless, it is upon technical objections of this kind, that acquittals follow, in spite of the strongest presumptions of guilt. This is a question for which every medical witness should be prepared, whether he is giving his evidence at a coroner's inquest, or in a Court of law. Many might feel disposed to regard matters of this kind as involving unnecessary nicety and care, but if they are neglected it is possible that a case may be at once stopped: so that the care subsequently bestowed upon a chemical analysis will be labour thrown away. Evidence of the presence of poison in the contents of a stomach was once rejected at a trial for murder, because they had been hastily thrown into a jar borrowed from a neighbouring grocer's shop; and it could not be satisfactorily proved that the jar was clean and entirely free from traces of poison (in which the grocer dealt) when used for this purpose. When the life of a human being is at stake, as in a charge of murder by poisoning, the slightest doubt is always very properly interpreted in favour of the accused.

Not only must clean vessels be used for receiving any liquid destined for subsequent chemical analysis, but care must be taken that the *identity* of a substance is preserved, or the most correct analysis, afterwards made, will be inadmissible as evidence. The suspected substance, when once placed in his hands, should never be let out of his sight or custody. It should be kept sealed under his private seal, and locked up while in his possession, in a closet to which no other person has a key. If he has once let it out of his hands, and allowed it to pass through the hands of several other persons, then he complicates the evidence for the prosecution, by rendering it indispensable for these persons to state under what circumstances it was placed while in their possession. The exposure of a suspected substance on a table, or in a closet or room, to which many have access, may be fatal to its identity; for the chemical evidence, so important in a criminal investigation, will probably be altogether rejected by the Court. A case was tried on the Norfolk circuit, in which the analysis of the matters vomited by a person poisoned by arsenic, was not admitted as evidence against the prisoner, because the practitioner had left them in the custody of two ignorant women; and these women had allowed the vessel containing the suspected liquid (which was proved to contain arsenic) to be exposed in a room open to the access of many persons. In another case, tried at the Old Bailey Sessions in 1835, the analysis of some suspected liquids was not allowed in evidence, because the practitioner, who lived in the country, and was unwilling to take the responsibility of analyzing them, had sent them up to town by a carrier to be examined by a London chemist. If closely sealed by a private seal, and this be observed by the receiver to be unbroken, before he proceeds to the analysis, this mode of transmission will not probably be objected to. When any article (*e. g.* a stomach or other organ) is reserved for analysis, care should be taken to attach immediately to it, or the vessel containing it, a parchment or wooden label, upon which is plainly written in ink, the name of the deceased and the date of removal, including the day of the week and month. This is especially necessary when there are two or more articles for analysis. I have known the greatest inconvenience to result from the neglect of this simple precaution.

Preserving articles for analysis.—In removing viscera or liquids from the body, and reserving them for analysis, it is necessary to observe certain precautions. A clean vessel with a wide mouth should be selected: it should be only sufficiently large to hold the viscus or liquid (the less air remaining in it the better); it should be secured by a closely fitting cork, covered with fine skin or bladder. Another piece of skin should then be tied over the mouth, or, for this, sheet-caoutchouc may be substituted with advantage. It should lastly be covered with tin-foil, and a layer of white leather. In this way any loss by evaporation or decomposition is prevented, and the viscera may be preserved (in a cool place) for some time. If the mouth of the vessel be too wide for a cork, the other articles cannot be dispensed with. Paper only should not be used: I have known the appearances after death of the viscera of an infant, suspected to have died from poison, entirely destroyed by drying, from the evaporation which took place through the layers of paper with which the vessel in which they were contained was covered. The practitioner should bear in mind that all these matters are likely to come out in evidence: and whatever is worth doing at all, is worth doing well. For reasons already stated, antiseptic chemical compounds should not be used. The addition of a small quantity of chloroform to the viscera will tend to preserve them.

On the use of Notes.—It has already been recommended as a rule in these criminal investigations, that a practitioner should make notes of what he observes in regard to symptoms, appearances after death, and the results of a chemical analysis. His own observations should be kept distinct from observations made by others and reported to him. He may base his conclusions on the former, but not on the latter. From the common forms of law in this country, an individual charged with the crime of poisoning may remain imprisoned, if at a distance from the metropolis, for some months before he is brought to trial. It is obvious, however clear the circumstances may at the time appear to a practitioner, that it will require more than ordinary powers of memory to retain for so long a period a distinct recollection of all the facts of the case. If he is unprovided with notes, and his memory is defective, then the case will turn in favour of the prisoner, for he will be the party to benefit by the neglect of the witness. In adopting the plan here recommended, such a result may be easily prevented. It may be remarked that the law relative to the admissibility of notes or memoranda in evidence is very strict, and is rigorously enforced by the judges. In order to render such notes or memoranda admissible, it is indispensably necessary that they should be taken on the spot at the time the observations are made, or as soon afterwards as practicable; and, further, it must be remembered that a witness can refer to them only for the purpose of refreshing his memory.

Medico-legal Reports.—One of the duties of a medical jurist is to draw up a report of the results of his examination: 1, in regard to symptoms; 2, in regard to the appearances after death; and, 3, in regard to the results of an analysis. With respect to the two first divisions of the report, I must refer the reader to the rules for investigating cases of poisoning. It need hardly be observed that the time at which the person was first seen, and the circumstances under which the attendance of the practitioner was required, as well as the period of death, should be particularly stated. The hour, the day of the week, and the day of the month, should be invariably mentioned. Some medical witnesses merely state the day of the week, without that of the month, or vice versâ. At a trial this creates great confusion, by rendering a reference to almanacs necessary. The words yesterday, next day, &c., should never be used. The facts which it will be necessary to enter in the report are specially stated under the heads of investigation (see pp. 30-32). If these facts are not observed in the order there set down, their value as evidence of the cause of death, or of the criminality or innocence of particular parties, will be entirely lost. In drawing up a report of symptoms and appearances after death, the facts should be in the first instance plainly and concisely stated *seriatim*, in language easily intelligible to non-professional persons. A reporter is not called upon to display his erudition, but to make himself understood. If technical terms are employed, their meaning should be stated in parentheses. When a subject is thoroughly understood, there can be no difficulty in rendering it in simple language; and when it is not well understood, the practitioner is not in a position to make any report. Magistrates, coroners, and barristers, are very acute, and easily detect ignorance, even when it appears under the mask of erudition.

In recording facts a reporter should not encumber his statements with opinions and inferences. His conclusions should be reserved until the end of the report. The language in which conclusions are expressed, should be precise and clear. It must be remembered that these are to form a concise summary of the whole report, upon which the judgment of a magistrate, or the decision of a coroner's jury, will be ultimately based. They should be most strictly confined to the matters which are the subject of inquiry, and which have fallen under the observation of the witness. Thus, they commonly refer to the following questions:—What was the cause of death? What are the medical circumstances which lead you to suppose that death was caused by poison? What are the circumstances which lead you to suppose that death was *not* caused by natural disease? Answers to one or all of these questions comprise, in general, all that the reporter is required to introduce into the conclusions of his report.

The reporter must remember that his conclusions are to be based only upon *medical* facts,—not upon moral circumstances, unless he is specially required to express his opinion with regard to them when they are of a medico-moral nature. Further, they must be founded only on what *he has himself seen or observed*. Any information derived from others should not be made the basis of an opinion in a medico-legal report. It is scarcely necessary to remark that a conclusion based upon mere *probabilities* is of no value as evidence.

In drawing up a report on the *results of a chemical analysis*, the following rules may be borne in mind. A liquid or solid is received for analysis. 1. When, and of whom, or how received? 2. In what state was it received—secured in any way, or exposed? 3. If more than one substance received, each to be separately and distinctly labelled; appearance of the vessel, its capacity, and the quantity of liquid (by measure) or solid (by weight) contained therein. 4. Where and when did you proceed to make the analysis, and where was the substance kept during the intermediate period? 5. Did any one assist you, or did you make the analysis yourself? 6. Physical characters of the substance. 7. Processes and tests employed for determining whether it contained poison. All the steps of these processes need not be described;—a general outline of the analysis will suffice. The magistrate may thus satisfy himself by an appeal to others (if necessary) whether the analysis has or has not been properly made. 8. Supposing the substance to contain poison,—is this in a pure state or mixed with any other body? 9. The strength of the poison, if an acid, or if it be in solution: in *all* cases, the *quantity* of poison present. 10. Supposing no poison to be contained in it, what was the nature of the substance? Did it contain anything likely to injure health or destroy life? 11. Could the supposed poisonous substance exist naturally or be produced within the body? 12. Was it present in any of the liquids or solids employed in the chemical analysis? 13. Was it contained in any of the articles of food or medicine taken by the deceased? 14. Is its presence to be ascribed to the use of any mineral matter employed by injection after death for the preservation of the body of the deceased? 15. What quantity of poison was actually separated? 16. How much of the substance found would, under the circumstances, be likely to destroy life?

In reference to the presence of arsenic in articles of food (13), it has been shown by Dr. Davy and Mr. Horsley that turnips and other vegetables, grown on soils which have been manured with arsenicated manures (now so extensively used), are liable to acquire an impregnation of arsenic. (Philosoph. Mag., Aug. 1859, p. 108; and Guy's Hosp. Reports, Oct. 1860.)

There are few reports in which answers to many of these questions, although not formally put, will not be required: and unless the whole of them are borne in mind by the operator at the time an analysis is undertaken, those which are omitted can never receive an answer, however important to the ends of justice that answer may ultimately become.

The articles used for the preservation of viscera should be in all cases scrupulously examined. Some kinds of calico are dressed with arsenic and starch paste, and many kinds of wrapping-paper as well as wall-papers are strongly impregnated with this poison. An observation made by Mr. Aickin of Belfast, shows that this is not an unnecessary caution. This gentleman was engaged in examining the body of a child, in order to determine the cause of death. The organs were healthy, and as no sufficient cause presented itself, he removed the stomach with a view of making an analysis of its contents. He was suddenly called away; and, to preserve the stomach, he wrapped it in a piece of paper (used for papering rooms), placing it on the uncoloured side, and he locked it in a closet until the following day. Assisted by a friend, he then analysed the contents, and found a trace of morphia with a pretty large quantity of arsenic. As the symptoms from which the child had died were not those of poisoning by arsenic, and there were no appearances of the action of arsenic on the body, he came to the conclusion that there must be some extraneous cause to account for the presence of this poison. He examined a portion of the wall-paper in which the stomach had been wrapped, and then found that that part of it which was coloured yellow, was tinted with sulphuret of arsenic or orpiment! It was therefore evident, as orpiment contains white arsenic, that the stomach and its contents had imbibed a portion of the poison during the night. (Lancet, June 23rd, 1855, p. 632.) This satisfactorily accounted for the presence of arsenic under circumstances which might have given rise to a false charge of murder. Nearly all wall-papers, having any tinge of green or golden yellow in them, contain arsenic, and this arsenic spreads by imbibition to other parts of the paper not so tinted. It would, of course, be proper to avoid in all cases the use of any wrapper having upon it mineral colours of any description. Mr. Aickin's case shows in a striking point of view the danger of trusting to chemical analysis alone. Unless we look to physiology and pathology, a most erroneous opinion may be expressed.

According to Professor Otto, of Brunswick, arsenic is generally found mixed with iron in all ochreous deposits. It is thus occasionally present in the soil of cemeteries but in an insoluble form. Even in the fur deposited in tea-kettles, in which there is generally some oxide of iron, arsenic has been found. From about a pound and a half of the crust or fur of a vessel, and from boiling water, he obtained well-marked arsenical deposits. Pöllnitz has detected in the fur of kettles,—copper, lead, tin, and even antimony. Dr. Osborn, of Southampton, has recently confirmed Pöllnitz's conclusion, namely, that lead is present in an insoluble form in the deposits of kettles and boilers. (Med. Times and Gaz., Dec. 22, 1860, p. 608.) Otto discovered a much larger proportion of arsenic in the calcareous crust taken from a kitchen boiler. Ten ounces of this gave a deposit of arsenic in a glass tube, and several stains on porcelain. He thinks that if a sufficient quantity is employed, arsenic will be found in all spring and well waters (Ausmittelung der Gifte, 1856, p. 61). I have found arsenic in the water of rivers used for the supply of towns, and have extracted a well-marked quantity from two ounces of the dried mud of the Thames. (Guy's Hosp. Reports, Oct. 1860, on Arsenic and Antimony.) These facts, if they prove any thing, tend to show the extreme danger of placing reliance on minute chemical results in the absence of good physiological and pathological evidence.

The results of analysis in the shape of sublimates or precipitates, should be preserved as evidence distinctly labelled in small glass-tubes hermetically sealed. They can then, if asked for, be produced for examination at the inquest or trial.

IRRITANT POISONS.

CHAPTER 5.

SULPHURIC ACID OR OIL OF VITRIOL. SYMPTOMS CAUSED BY THIS POISON IN THE CONCENTRATED AND DILUTED STATE — APPEARANCES AFTER DEATH. QUANTITY OF ACID REQUIRED TO DESTROY LIFE — FATAL DOSE — PERIOD AT WHICH DEATH TAKES PLACE — CHEMICAL ANALYSIS — MODE OF DETECTING THE POISON IN PURE AND MIXED LIQUIDS — ITS DETECTION IN ARTICLES OF CLOTHING — POISONING BY SULPHATE OF INDIGO.

Sulphuric Acid, or Oil of Vitriol.

Symptoms.—When this poison is swallowed in a concentrated form, the symptoms produced come on *immediately*, or during the act of swallowing. There is violent burning pain, extending through the throat and gullet to the stomach — the pain is often so severe that the body is bent. There is an escape of gaseous and frothy matter, followed by retching and vomiting, the latter accompanied by the discharge of shreds of tough mucus and of a liquid of a dark coffee-ground colour, mixed with blood. The mouth is excoriated, the lining membrane and surface of the tongue white, or resembling soaked parchment—in one instance the appearance of the mouth was as if it had been smeared with white paint: after a time, the membrane acquires a grey or brownish colour; the cavity is filled with a thick viscid substance consisting of saliva, mucus, and the membrane of the mouth ·—this renders speaking and swallowing difficult. If the poison has been administered by a spoon, or the phial containing it has been passed to the back of the fauces, the mouth may escape the chemical action of the acid. A medical witness must bear this circumstance in mind, when he is called to examine an infant suspected to have been poisoned by sulphuric acid. Around the lips and on the neck may be found spots of a brown colour from the action of the acid on the skin. There is great difficulty of breathing, owing to the swelling and excoriation of the throat and larynx, and the countenance has from this cause a bluish or livid appearance;—the least motion of the abdominal muscles is attended with increase of pain. These symptoms have been sometimes mistaken for those of disease. (Henke, Zeitschrift der S. A. 1843, ii. 284.) The stomach is so irritable, that whatever is swallowed is immediately ejected, and the vomiting is commonly violent and incessant. In a case reported by Dr. Geoghegan, of Dublin, the patient (a female) vomited for three or four hours. This symptom then ceased, and did not recur, although she did not die until thirty-four hours after the poison had been swallowed. (Med. Gaz. vol. 48. p. 328.) The matters *first* vomited generally contain the poison: they are acid, and if they fall on a limestone pavement there is effervescence, if on coloured articles of dress, the colour is sometimes altered to a red or yellow (if logwood), or the colour is discharged and the texture of the stuff destroyed:—on a black cloth dress, the spots produced by the concentrated acid are brown, and remain moist for a considerable time. An attention to these circumstances may often lead to a suspicion of the real cause of the symptoms, when the facts are concealed. After a time there is great exhaustion, accompanied by general weakness:—the pulse becomes quick, small, and feeble; the skin cold, mottled, and covered with a clammy sweat. There is generally great thirst, with obstinate constipation of the bowels;—should any evacuations take place, they are commonly either of a dark brown or leaden colour,—in some instances almost black arising from the admixture of altered blood. There are sometimes convulsive motions of the muscles, especially those of the face and lips. The countenance, if not livid from obstructed respiration, is pale, expressive of great anxiety, and of intense suffering. The intellectual faculties are quite clear, and death usually takes place very suddenly, in from eighteen to twenty-four hours after the poison has been taken.

Appearances after death.—The marked effects of this poison are not always found in the stomach; they may be confined to the region of the throat and windpipe. In an inspection of the body, the whole course of the alimentary canal, from the mouth downwards, should be examined; since in recent or acute cases it is in the throat and gullet that we generally obtain strong evidence of the action of a corrosive poison. The discovery of the usual marks of corrosion in these parts is always highly corroborative of the signs of poisoning found in the stomach. During the inspection, the examiner must not omit to notice any spots on the skin produced by the action of the acid:—these are commonly of a dark brown colour, and are situated about the mouth, lips, and neck. The appearances met with in the body will vary, according to whether death has taken place rapidly or slowly. Supposing the case to have proved fatal very rapidly, the membrane lining the mouth may be found white, softened, and corroded. The mucous membrane of the throat and gullet will commonly be found corroded, having a brown-black, or ash-grey colour: blood is effused in patches beneath it. The corroded membrane of the gullet is occasionally disposed in longitudinal folds, portions of it being partly detached. The *stomach*, if not perforated, is collapsed and contracted. On laying it open, the contents are commonly found of a dark brown or black colour and of a tarry consistency, being formed in great part of mucus and altered blood. The contents may or may not be acid, according to the time the patient has survived, and the treatment which has been adopted. On removing them, the stomach may be seen traversed by black lines, or the whole of the mucous membrane may be corrugated, and stained black or of a dark brown colour. This blackness is not entirely removed by washing. On stretching the stomach, traces of inflammation may be found between the folds, indicated by a deep crimson red colour. On forcibly removing the blackened membrane, the red colour indicative of inflammation may be seen in the parts beneath. Both the dark colour and marks of inflammation are sometimes partial, being confined to insulated portions of the mucous membrane. When the stomach is perforated, the coats are softened, and the edge of the aperture is commonly black and irregular. In removing the stomach, the aperture is liable to be made larger by the mere weight of the organ. The contents do not always escape; but when this happens, the surrounding viscera are attacked by the poison. In a case which occurred at Guy's Hospital, the spleen, the liver, and the coats of the aorta, were found blackened and corroded by the acid, which had escaped through the perforation. When the person has survived for eighteen or twenty hours, traces of corrosive and inflammatory action may be found in the small intestines. In one case the mucous membrane of the ileum was corroded. The interior of the windpipe as well as of the bronchial tubes, has also presented marks of the local action of the acid. The acid has thus destroyed life without reaching the stomach. A remarkable instance in which the poison penetrated into and destroyed both lungs has been reported by Dr. Gull. (See Med. Gaz. vol. 45. p. 1102.) It is important for a medical witness to bear in mind, that the mouth, throat, and gullet are not always found in the state above described. Dr. Ogle met with a case in which the membrane of the tongue was but slightly affected. The man had swallowed a large dose of the poison and had died in nine hours. (Med. Times and Gazette, April 21, 1860.) Strange as it may appear, cases are recorded in which, notwithstanding the introduction of this poison into the stomach, the gullet has escaped its chemical action. Mr Dickinson has reported a case of poisoning by sulphuric acid in which there was no corrosion of the mouth and throat. The patient, a female, æt. 52, recovered in about five months. The stomach had probably sustained injury, as the most urgent symptoms were constant vomiting after taking food, and obstinate constipation. The quantity of acid swallowed was half an ounce, mixed with half an ounce of water. The patient *immediately* felt a burning sensation at the pit of the stomach (Lancet, Nov. 26, 1853, p. 502). The acid had here evidently lost its corrosive power by dilution. (See Poisons—*Sulphuric Acid.*) When the acid has been taken in a still more *diluted* state, the marks of inflammation on the mucous membrane are less decided, and the blackening is not so considerable. Nevertheless, the acid, unless too much diluted, acts upon and darkens the blood in the vessels, as well as that contained in the stomach, although it may not blacken the mucous membrane or the contents.

Dr. Walker, of Inverness, met with a case in which a man, æt. thirty, swallowed fifteen drachms and a half of sulphuric acid (sp. gr. 1·842), and died twenty-five hours afterwards. Half an hour after taking the poison he resembled a patient in the collapsed stage of cholera. The inside of the lips, tongue, and throat were swollen, and had the appearance of being smeared with thin arrow-root. He suffered severe pain, but did not vomit until *three-quarters of an hour* had elapsed from the time of taking the poison: the vomiting appeared to be then excited by the liquid given to him. The vomited matters were dark, bloody and viscid. The patient was sensible up to the time of his death. An inspection revealed the usual appearances. The mucous membrane of the stomach was destroyed, and the whole surface darkened. The greatest amount of injury was at the pyloric end, where three small perforations were found. The orifice of the pylorus was swollen, constricted, and hardened; it was so small as to admit only a silver probe. The duodenum had also suffered. The first two inches of the arch of the aorta were very much inflamed. There were no traces of the acid in the stomach; there was a slight trace in the duodenum: a trace in the serous fluid at the base of the brain:—but the largest quantity was found in the blood contained in the heart. (Edin. Mon. Jour. June, 1850, p. 538.) This case is remarkable in the fact that vomiting was not immediate; that there were no spots on the outside of the face; that the poison was swallowed in large quantity on an empty stomach; and there was free voluntary exertion, as, twenty hours after he had taken the poison, the man got out of bed and sat on a night-stool. Dr. Geoghegan, of Dublin, has published in the London Medical Gazette (vol. 48, p. 328), a full account of the symptoms and appearances after death in a well-marked case of poisoning by sulphuric acid, as well as of a process for detecting this poison when absorbed.

Quantity required to destroy life.—The dangerous effects of this poison appear to arise rather from its degree of concentration, than from the absolute quantity taken. The quantity actually required to prove fatal must depend on many circumstances. If the stomach is full when the poison is swallowed, the action of the acid may be spent on the food and not on the stomach; and a larger quantity might then be taken than would suffice to destroy life if the organ were empty. The smallest quantity which is described as having proved fatal was in the following case:—Half a tea-spoonful of concentrated sulphuric acid was given to a child about a year old by mistake for castor oil. The usual symptoms came on, with great disturbance of breathing; and the child died in twenty-four hours. The quantity here taken could not have exceeded *forty drops*. (Med. Gaz. vol. 29. p. 147.) It is, however, doubtful whether this small quantity would have proved fatal to an adult. The smallest fatal dose which Dr. Christison states he has found recorded, was *one drachm;* it was taken by mistake by a stout young man, and killed him in seven days. (Op. cit. 162.)

Period at which death takes place.—It has been already stated, that the average period at which death takes place in cases of acute poisoning by sulphuric acid is from eighteen to twenty-four hours. When the stomach is perforated by the acid, it commonly proves more speedily fatal. In one instance, reported by Dr. Sinclair, a child about four years old died in four hours—the stomach was perforated. When the poison acts upon the windpipe, death may be a still more speedy consequence from suffocation; and, owing to this, it appears to be more rapidly fatal to children than adults. Dr. Craigie mentions a case in which three ounces of concentrated sulphuric acid destroyed life in three hours and a half. Remer met with an instance in which death took place *in two hours*. A case is reported by Mr. Watson, in which a woman swallowed two ounces of the strong acid. She died in *half an hour*, but it appears that a quarter of an hour before death she had made a deep wound in her throat, which gave rise to great bleeding. The stomach was found extensively perforated:—but it is highly probable that the wound accelerated death in this case. The shortest case recorded occurred to M. Rapp. A man, æt. fifty, swallowed three ounces and a half of concentrated sulphuric acid He died in *three-quarters of an hour*. (Gazette Medicale, Dec. 28, 1850.) On the other hand, there are numerous instances reported in which the poison proved fatal from secondary causes, at periods varying from one week to several months.

Chemical analysis.—This acid may be met with either concentrated or diluted; and a medical jurist may have to examine it under three conditions:—1. In its simple state.—2. When mixed with organic matters, as with liquid articles of food, or in the contents of the stomach.—3. On solid organic substances, as where the acid has been thrown or spilled on articles of dress or clothing.

In the simple state.—If *concentrated,* it possesses these properties:—1. A piece of wood, sugar, or other organic matter plunged into it, is speedily carbonised or charred.—2. When boiled with wood, copper-cuttings, or mercury, it evolves fumes of sulphurous acid; this is immediately known by the odour, as well as by the acid vapour first rendering blue, and then bleaching, starch-paper dipped in a solution of iodic acid.—3. When mixed with an equal bulk of water, great heat is evolved (nearly 200° F. in a cold vessel).

The diluted acid.—For the acid in a diluted state, but one test may be applied: — a solution of a salt of baryta. — the *Nitrate of baryta*, or the *Chloride of barium.* Having ascertained by test-paper that the liquid is acid, we add to a portion of it a few drops of nitric acid, and then a solution of nitrate of baryta. If sulphuric acid be present, a dense white precipitate of sulphate of baryta will fall down—which is insoluble in all acids and alkalies. If this precipitate be collected, dried, and heated to redness in a small platina crucible, or in a folded piece of platina foil, with five or six parts of charcoal powder, it will, if a sulphate, be converted to sulphuret of barium. To prove this, we add to the calcined residue, hydrochloric acid, at the same time suspending over it a slip of filtering paper moistened with a solution of acetate of lead, or, what is more convenient, we place the residue on a slip of glazed card (coated with carbonate of lead), scraped and wetted on the surface. (The card should be first tested for lead: because some kinds of glazed cards are made without lead.) If the original precipitate was a sulphate, the gas now evolved will be sulphuretted hydrogen, known by its odour, and by its turning the salt of lead, or staining the card of a brown colour. The smallest visible quantity of sulphate of baryta thus admits of easy detection.

In liquids containing organic matter. — If sulphuric acid is mixed with such liquids as porter, coffee, or tea, the process for its detection is substantially the same, the liquid being rendered clear by filtration through paper or well-washed gun-cotton previously to adding the test. The sulphate of baryta, if mixed with organic matter, may be purified by boiling it in strong nitric acid: but this is not commonly necessary, as the reduction of the dried precipitate may be equally well performed with the impure, as with the pure sulphate. Some liquids generally contain sulphuric acid or a sulphate, such as vinegar and porter, but the acid is in minute proportion: therefore, if there is an abundant precipitate, there can be no doubt, *cæteris paribus.*

that free sulphuric acid has been added to them. Should the liquid be thick and viscid like gruel, it may be diluted with water, and then boiled with the addition of a little acetic acid. For the action of the test, it is not necessary that the liquid should be absolutely clear, provided it be not so thick as to interfere mechanically with the precipitation of the sulphate of baryta. So far with regard to articles administered, or of which the administration has been attempted. A similar process may be applied to the examination of matters *vomited* and of the *contents of the stomach*,—care being taken to separate the insoluble parts by filtration, before adding the test.

On solid organic substances.— It sometimes happens in cases of poisoning by sulphuric acid that it is spilled upon articles of clothing, such as cloth or linen, and here a medical jurist may succeed in detecting it, when every other source of chemical evidence fails. Again, sulphuric acid is often used for the purpose of seriously injuring a party, as by throwing it on the person,—an offence which, when accompanied with bodily injury, renders the offender liable to a severe punishment. On such occasions, proof of the corrosive nature of the liquid is required; and this is easily obtained by a chemical examination of a part of the dress. The process of analysis is very simple. The piece of cloth should be digested in a small quantity of distilled water at a gentle heat, whereby a brownish coloured liquid is obtained on filtration. If sulphuric acid is present, the liquid will have a strong acid reaction, and produce the usual effects with the barytic test. Old stains are known by the complete destruction of the organic fibre.

SULPHATE OF INDIGO.

Several cases of accidental poisoning by this substance have occurred. As the compound is nothing more than a solution of indigo in strong sulphuric acid, the symptoms and appearances after death are the same as those which have been described for the latter substance. This kind of poisoning may be suspected when, with these symptoms, the membrane of the mouth has a blue or blue-black colour. The vomited matters, as well as the fæces, are at first of a deep blue-black tint; afterwards green; and it was observed in two instances that the urine voided by the patients had a blue tinge.

It is proper to notice, that as Indigo is one of the substances now directed by the statute to be mixed with arsenic when sold in small quantities, the detection of this colouring principle in the mouth and vomited matters will not necessarily show that it has been taken in the form of sulphate.

CHAPTER 6.

POISONING BY NITRIC ACID OR AQUA FORTIS. ACTION OF THE CONCENTRATED ACID—APPEARANCES AFTER DEATH—QUANTITY REQUIRED TO DESTROY LIFE—PERIOD AT WHICH DEATH TAKES PLACE. PROCESSES FOR DETECTING THE POISON IN PURE AND ORGANIC LIQUIDS. — POISONING BY HYDROCHLORIC ACID.

Nitric acid is popularly known under the name of Aqua fortis, or Red spirit of nitre. According to Tartra, it seems to have been first used as a poison about the middle of the fifteenth century. Although it is perhaps much more used in the arts than oil of vitriol, cases of poisoning by it are by no means common.

Symptoms.—When the acid is in a concentrated state, the symptoms, on the whole, bear a close analogy to those produced by sulphuric acid. They come on *immediately*, and the swallowing of the acid is accompanied by intense burning pain in the throat and gullet extending downwards to the stomach:—there are gaseous eructations, from the chemical action of the poison,—swelling of the abdomen, violent vomiting of liquid or solid matters, mixed with altered blood of a dark brown colour, and shreds of mucus, having a strong acid reaction. The abdomen is generally exquisitely tender: but in one well-marked case of poisoning by this acid, the pain was chiefly confined to the throat: probably the poison had not reached the stomach. The mucous membrane of the mouth is commonly soft and white, after a time becoming yellow, or even brown; the teeth are also white, and the enamel is partially destroyed by the chemical action of the acid. There is great difficulty of speaking, as well as of deglutition, the mouth being filled with viscid mucus: the power of swallowing is sometimes entirely lost. On opening the mouth, the tongue may be found swollen, and of a citron colour; the tonsils are also swollen and enlarged. The difficulty of respiration is occasionally such, as to render tracheotomy necessary, especially in young persons. (See case by Mr. Arnott, Med. Gaz. 12. 220.) As the symptoms progress, the pulse becomes small, frequent, and irregular,—the surface of the body extremely cold, and there are frequent rigors (shivering). The administration of remedies,—even the swallowing of the smallest quantity of liquid, increases the severity of the pain, occasions vomiting, and gives rise to a feeling of laceration or corrosion. (Tartra, 144.) There is obstinate constipation. Death takes place in from eighteen to twenty-four hours, and is sometimes preceded by a kind of stupor, from which the patient is easily roused. The intellectual faculties commonly remain clear until the last. In one instance the patient was insensible, but she ultimately recovered. Death may be occasioned by this acid, in consequence of its action on the larynx, as in the case of sulphuric acid. Should the patient survive the first effects of the poison, the mucous membrane of the throat and gullet may be discharged, either in irregular masses, or in the form of a complete cylinder of the œsophageal lining. There is great irritability of the stomach, with pain on taking food, frequent vomiting and ultimate destruction of the powers of digestion: the patient becomes slowly emaciated, and dies, sometimes after many months, from starvation or exhaustion. A man swallowed nitric acid in beer: he recovered from the first symptoms, but died six months afterwards, evidently from the injury caused by the poison to the mucous lining of the stomach. He suffered from pain and from such irritability in this organ that neither solids nor fluids could be retained. (Lancet, Nov. 24, 1860, p. 510.)

The *Vapour* of this acid may destroy life. In March, 1854, *Mr. Haywood*, a chemist of Sheffield, lost his life under the following circumstances:—He was pouring a mixture of nitric and sulphuric acids from a carboy containing about sixty pounds, when by some accident the vessel was broken. For a few minutes he inhaled the fumes of the mixed acids, but it does not appear that any of the liquid fell over him. Three hours after the accident, he was sitting up and appeared to be in moderately good health. He was then seen by a medical man, and complained merely of some cuts about his hands. He coughed violently. In three hours more there was difficulty of breathing, with increase of the cough. There was a sense of tightness at the lower part of the throat, and the pulse was hard. At times he said he could scarcely breathe. He died eleven hours after the accident. On inspection, there was congestion of the trachea and bronchial tubes, with effusion of blood in the latter. The heart was flaccid, and contained but little blood; and the lining membrane of the heart and aorta was slightly inflamed. The blood gave a slightly acid reaction with test paper. The windpipe was not examined. It is very probable the seat of mischief was in this organ, and that the deceased died from inflammatory effusion and enlargement of the parts about the opening of the windpipe. (Lancet, April 15, 1854, p. 430.) The vapours produced by a mixture of strong nitric and sulphuric acids are of a most noxious and irritating kind. On one occasion, in preparing gun-cotton, I accidentally inhaled the vapour, and suffered from severe constriction of the throat, tightness in the chest, and cough for more than a week.

Appearances after death.—Supposing death to have taken place rapidly, the following appearances will be met with. The skin of the mouth and lips will present various shades of colour, from an orange-yellow to a brown; it appears like the skin after a blister or burn, and is easily detached from the subjacent parts. Yellow spots produced by the spilling of the acid may be found about the hands and neck. A yellow frothy liquid escapes from the nose and mouth, and the abdomen is often much distended. The membrane lining the mouth is sometimes white, at others of a citron colour; the teeth are white, but present a yellowish colour about the coronæ. The pharynx and larynx are much inflamed; the latter sometimes œdematous. The lining membrane of the gullet is softened, and of a yellow or brown colour, easily detached, often in long folds: The trachea is more vascular than usual, and the lungs are congested. The most strongly marked changes are, however, seen in the stomach. When not perforated, this organ may be found distended with gas,—its mucous membrane partially inflamed, and covered by patches of a yellow, brown, or green colour, or it may be even black. This green colour is due to the action of the acid on the colouring matter of the bile; but it must be remembered that a morbid state of the bile itself may give this appearance to the mucous membrane in many cases of death from natural disease. There is occasionally inflammation of the peritoneum, and the stomach is glued to the surrounding organs. Its coats are often so much softened, as to break down under the slightest pressure. In the duodenum similar changes are found; but in some cases the small intestines have presented no other appearance than that of slight redness. It might be supposed that the stomach would be in general perforated by this corrosive liquid: but this appearance has not been often observed. Tartra only met with two instances, and in one of these the person survived twenty, and in the other thirty hours. In giving this poison to rabbits, I have not found the stomach perforated, although the acid had evidently reached that organ, as its coats were stained of a deep yellow colour. In these experiments the non-perforation appeared to be due to the protective influence of the food with which the stomach was distended. In the few cases that are reported in English journals, it would appear that the stomach has not been perforated: the poison had been swallowed soon after a meal, and its coats had thus escaped the corrosive action of the acid. In the case above referred to (p. 49), which proved fatal after the long period of six months, there was at the intestinal end of the stomach a distinct cicatrix with puckering and hardening of the surrounding mucous membrane, causing a slight contraction of the pyloric orifice. The only other appearance consisted in some dark longitudinal lines on the posterior surface of the lining membrane of the gullet. This had probably been caused by the acid. (Lancet, Nov. 24, 1860, p. 510.)

Quantity required to destroy life.—The *smallest* quantity of this acid which I find reported to have destroyed life, is about *two drachms.* It was in the case of a boy, aged thirteen: he died in about thirty-six hours. But less than this, even one drachm, would doubtless suffice to kill a child; and, under certain circumstances, an adult; for the fatal result depends on the extent of the mischief produced by this corrosive poison in the windpipe, gullet, and stomach. What is the largest dose of concentrated acid from the effects of which a person has recovered, it is difficult to say; since in most of the cases of recovery mentioned by authors, the quantity of the poison taken was unknown.

Period at which death takes place.—Sobernheim relates a case of poisoning by nitric acid, which proved fatal in *one hour and three quarters.* (Op. cit. 402.) This I believe to be the *most rapidly* fatal case on record, where the acid acted as a poison. The usual well-marked effects were found in the gullet, stomach, and small intestines. In infants, however, life may be destroyed by this poison in a few minutes, should it happen to affect the larynx. The longest case is, perhaps, that recorded by Tartra, where a woman perished from exhaustion, produced by the secondary effects of the poison, *eight months* after having swallowed it.

Chemical analysis.—In the simple state.—This acid may be met with either concentrated or diluted. The *concentrated acid* varies in colour from a deep orange red to a light straw yellow. It may be recognized,—1. By evolving acid fumes when exposed.—2. By its staining organic matter yellow or brown, the colour being heightened and turned to a reddish tint by contact with caustic alkalies.—3. When mixed with a few copper cuttings, it is rapidly decomposed—a deep red acid vapour is given off, and a greenish coloured solution of nitrate of copper is formed. Tin or mercury may be substituted for copper in this experiment. 4. The addition of gold-leaf and a few drops of hydrochloric acid. On warming the mixture if nitric acid be present the gold is dissolved. Common aqua fortis (nitric acid) frequently contains as impurity a sufficiency of hydrochloric acid to dissolve gold-leaf by heat.

In the diluted state.—This acid is not precipitated like the sulphuric by any common reagent, since all its alkaline combinations are soluble in water.—1. The liquid has a highly acid reaction, and on boiling it with some copper turnings, red fumes of nitrous acid vapour are given off, unless the proportion of water be very great. At the same time, the liquid acquires a blue colour.—2. A streak made on white paper with the diluted acid does not carbonize it when heated; but a scarcely visible yellow stain is left.—3. The liquid is neither precipitated by nitrate of baryta nor by nitrate of silver. These two last experiments give merely negative results—they serve to show that the sulphuric and hydrochloric acids are absent.

In order to detect nitric acid, the liquid should be carefully neutralized by potash, and then evaporated slowly to obtain crystals. If the liquid contain nitric acid, these crystals will possess the following characters:—1. They appear in the form of lengthened fluted prisms, which neither effloresce nor deliquesce on exposure. One drop of the solution evaporated spontaneously on glass will suffice to yield distinct and well-formed prismatic crystals. This character distinguishes the *nitrate* of potash from a large number of salts.—2. When moistened with strong sulphuric acid, the powdered crystals slowly evolve a colourless acid vapour. By this test, the nitrate is known from every other deflagrating salt.—3. A portion of the powdered crystals should be placed in a small tube and mixed with their bulk of fine *copper* filings. The mass is then to be moistened with water, and a few drops of strong *sulphuric acid* added. Either with or without the application of a gentle heat, a decomposition immediately ensues, by which red fumes of *nitrous acid* are evolved, recognizable by their colour, odour, and acid reaction.—4. We add to the crystals a small piece of gold-leaf and hydrochloric acid; then boil for a few minutes. The gold will either wholly or entirely disappear if nitric acid or a nitrate be present. Its partial solution will be indicated by a dark purple colour on the addition of chloride of tin to the liquid after boiling.

In liquids containing organic matter.—Nitric acid may be administered in such liquids as tea, vinegar, or porter. In this case, besides the acid reaction, there will be a peculiar smell produced by the acid, when mixed with substances of an organic nature. The application of the usual tests may be here counteracted:—thus, unless the quantity of nitric acid in the liquid is considerable, the orange-red fumes of nitrous acid are not evolved on boiling the liquid with copper cuttings. If the liquid is viscid this viscidity must be destroyed by dilution with water:—and in all cases, if any solid or insoluble substances be present, as in the *matters vomited* or *contents of the stomach*, it must be filtered, in order to separate the insoluble portions. This operation is commonly very slow. If we succeed in procuring a clear acid liquor, the colour may be disregarded. We should then carefully neutralize it with a weak solution of carbonate of potash. The liquid may be concentrated to a small bulk by evaporation, and a few drops crystallized on a piece of glass. The resulting crystals may be examined for those properties which have been described as characteristic of the compound of potash with nitric acid. The crystals so obtained may be coloured and impure. This circumstance does not at all interfere with the action of the most important test for nitric acid, namely the mixture of copper filings and sulphuric acid. The crystals may, however, if necessary, be purified by washing them with ether or alcohol. These liquids do not dissolve the nitrate of potash, but will often serve to remove from it the organic matters by which it is coloured. When either the nitric acid, or the nitrate to which it has been converted, is mixed with common salt, the copper test cannot be employed. The gold test will in such a case furnish the best evidence. Hydrochloric acid may be added to the dried residue, with a small portion of gold-leaf, and the mixture boiled. If nitric acid or a nitrate be present, even in minute proportion, some portion of the gold will be dissolved—a fact demonstrable by the addition of chloride of tin.

Nitric acid may be detected in *stains on clothing*, if recent, by simply boiling the stained cloth in water, with or without the addition of a small quantity of carbonate of potash. The carbonate must be used when an *acid* liquor is not obtained by boiling the stained cloth in distilled water.

HYDROCHLORIC ACID.

This acid, which is also called Muriatic acid, and is popularly known under the name of Spirit of salt, is but seldom taken as a poison. In the few cases which have been hitherto observed, the *symptoms* and *appearances* have been similar to those caused by nitric acid. One of the most recent cases of poisoning by this acid occurred in King's College Hospital, in May 1859. A woman, æt. sixty-three, swallowed *half an ounce* of concentrated hydrochloric acid. She was received into the hospital in three quarters of an hour. The prominent symptoms were burning pain in the throat and stomach, feeble pulse, cold and clammy skin, retching and vomiting of a brown matter streaked with blood and containing shreds of membrane. There was great exhaustion. The throat became swollen, the patient lost the power of swallowing, and died in eighteen hours. She retained her senses until the last. The *appearances* in the body were as follows:—the mucous membrane of the mouth and throat were white, softened, and stripped in many places by the corrosive action of the acid. The membrane of the gullet was red and inflamed. The back part of the stomach near the pylorus was black, stripped of its mucous membrane (which was generally softened), and marked with black lines. It was not perforated. (Lancet, July 16, 1859, p. 59.) In this case the smallest quantity of hydrochloric acid was taken which has as yet been known to prove fatal. I have elsewhere related a case of poisoning by this acid (Guy's Hosp. Rep. Oct. 1850, p. 211); and for other cases in which an ounce was taken and the persons recovered, see Lancet, July 27, 1850, p. 113, and the Medical Gazette, Dec. 28, 1849. For a more detailed account of poisoning by this acid, see On Poisons, second edition, p. 289.

CHAPTER 7.

POISONING BY THE VEGETABLE ACIDS. OXALIC ACID — SYMPTOMS AND EFFECTS — APPEARANCES AFTER DEATH — FATAL DOSES—RECOVERY FROM LARGE DOSES—PERIOD AT WHICH DEATH TAKES PLACE — CHEMICAL ANALYSIS — TESTS FOR OXALIC ACID IN PURE AND MIXED LIQUIDS — BINOXALATE OF POTASH. TARTARIC ACID. ACETIC ACID. VINEGAR.

Oxalic Acid.

Symptoms.—In many instances of poisoning by oxalic acid. death has taken place so rapidly, that the individual has not been seen alive by a medical practitioner. If the poison is taken in a large dose, *i. e.* from half an ounce to an ounce of the crystals dissolved in water, a hot burning acid taste is experienced in the act of swallowing it. This is accompanied by a similar sensation extending through the gullet to the stomach. There is sometimes a sense of constriction or suffocation: the countenance is livid and the surface of the skin soon becomes cold and clammy. Vomiting occurs either immediately or within a few minutes. Should the poison be diluted, there is merely a sensation of strong acidity, and vomiting may not occur until after a quarter of an hour or twenty minutes. In some cases there has been little or no vomiting: while in others, this symptom has been incessant until death. In a case which occurred to Dr. Page, in which an ounce of the acid was swallowed, the vomiting with pain in the stomach continued until the fifth day, when the man died suddenly. (Lancet, Nov. 24, 1860, p. 509.) In a case in which the poison was much diluted, vomiting did not occur for seven hours. (Christison, 221.) The vomited matters are highly acid, and have a greenish-brown or almost black colour: they consist chiefly of mucus and altered blood. In one instance, reported by Dr. Geoghegan, they were colourless. (Medical Gazette, vol. 37, p. 792.) In another case, reported by Mr. Deane in the Provincial Journal, fluid blood of a bright arterial colour was vomited after some hours. (June 25th, 1851, p. 344.) There is great pain and tenderness in the abdomen, with a burning sensation in the stomach. There are cold clammy perspirations and convulsions. In a case which occurred at Guy's Hospital, in May, 1842, in which about two ounces of the poison had been swallowed, there was no pain. Violent vomiting and collapse were the chief symptoms. There is in general an entire prostration of strength, so that if the person is in the erect position, he falls; there is likewise unconsciousness of surrounding objects, and a kind of stupor, from which, however, the patient may be without difficulty roused. Owing to the severity of the pain, the legs are sometimes drawn up towards the abdomen. The pulse is small, irregular, and scarcely perceptible; there is a sensation of numbness in the extremities, and the respiration, shortly before death, becomes spasmodic. The inspirations are deep, and a long interval elapses between them. Such are the symptoms commonly observed in a rapidly fatal case.

Should the patient survive the first effects of the poison, the following symptoms appear: there is soreness of the mouth, constriction and burning pain in the throat, with pain in swallowing,—tenderness in the abdomen, and irritability of the stomach, so that there is frequent vomiting, accompanied by purging. The tongue is swollen, and there is great thirst. The patient may slowly recover from these symptoms. In a case related by Mr. Edwards to the Westminster Medical Society, the patient, a female, lost her voice for eight days. In the early editions of this work, I have treated it as doubtful whether the loss of voice in this case depended on the action of the poison. A case has, however, been reported by Mr. T. W. Bradley, from which it may be inferred that loss of voice may result from the direct effect of oxalic acid on the nervous system. A man swallowed a quarter of an ounce of the acid, and suffered from the usual symptoms in a severe form. In about nine hours his voice, although naturally deep, had become low and feeble. This weakness of voice remained for more than a month, and its natural strength had not returned even after the lapse of nine weeks. During the first month there was numbness, with tingling of the legs. (Med. Times, Sept. 14, 1850, p. 292.) The occurrence of this sensation of numbness, and its persistence for so long a period after recovery from the symptoms of irritation, clearly point to a remote effect on the nervous system. Spasmodic twitchings of the muscles of the face and extremities have also been observed in some instances. (See Lancet, March 22, 1851, page 329.)

Appearances after death.—The mucous membrane of the tongue, mouth, throat, and gullet, is commonly white, as if bleached, but it is sometimes coated with a portion of the brown mucous matter discharged from the stomach. This latter organ contains a dark brown mucous liquid, often acid, and having almost a gelatinous consistency. On removing the contents, the mucous membrane will be seen pale and softened, without always presenting marks of inflammation or abrasion, if death have taken place rapidly. This membrane is soft and brittle, easily raised by the scalpel, and presents the appearance which we might suppose it would assume after having been for some time boiled in water. The small vessels are seen ramifying over the surface, filled with dark-coloured blood, apparently solidified within them. The lining membrane of the gullet presents the same characters. It is pale, and appears as if it had been boiled in water, or digested in alcohol; it has been found strongly raised in longitudinal folds, interrupted by patches where the membrane has become abraded. In a case which was fatal in eight hours, the tongue was covered with white specks; the gullet was not inflamed, but the stomach was extensively destroyed, and had a gangrenous appearance. Portions of the mucous membrane were detached, exposing the muscular coat. With respect to the intestines, the upper portion may be found inflamed; but, unless the case be protracted, the appearances in the bowels are not strongly marked. In a well-marked case of poisoning by this acid, however, which is recorded by Dr. Hildebrand, the mucous or lining membrane of the stomach and duodenum was much reddened, although the patient, a girl of eighteen, died in three quarters of an hour after taking one ounce of the acid, by mistake for Epsom salts. (Casper's Vierteljahrschrift, 1853, 3 B. 2 H. page 256.) In a case of poisoning by this acid, in which two ounces had been taken, and death was rapid, the coats of the stomach presented almost the blackened appearance produced by sulphuric acid, owing to the colour of the altered blood spread over them. In protracted cases, the gullet, stomach, and intestines have been found more or less congested or inflamed. In a case in which an ounce was swallowed, and death occurred on the fifth day, the stomach was slightly congested and contained a bloody fluid, but the mucous membrane was entire. (Lancet, Nov. 24, 1860, p. 509.)

I am indebted to Mr. Welch for the following case:—A woman aged twenty-eight, swallowed *three drachms* of the crystallized acid. She was found quite dead in *one hour* afterwards. On examining the body, both lungs were observed to be extensively congested, and the heart and large vessels were full of dark-coloured blood. The stomach contained about three quarters of a pint of a dark-brown fluid, and its lining membrane was generally reddened. The other organs, except the brain, were healthy, and this presented appearances indicative of long-standing disease. This case is remarkable from the smallness of the dose, the rapidity of death, and the well-marked redness of the mucous membrane of the stomach. The diseased state of the body may have tended to accelerate death from the poison in this case. In one instance the larynx was found filled with frothy mucus, and the left side of the heart and the lungs were gorged with dark-coloured fluid blood. In a few cases there have been scarcely any morbid appearances produced.

It is worthy of remark that the glairy contents of the stomach do not always indicate strong acidity until after they have been boiled in water. Oxalic acid does not appear to have a strongly corrosive action on the stomach, like that possessed by the mineral acids. It is therefore rare to hear of the coats of the organ being perforated by it. In many experiments on animals, and in some few observations on the human subject, I have found nothing to bear out the view that perforation is a common effect of the action of this poison. The acid undoubtedly renders the mucous coat soft and brittle, and perforation of the coats may occur either during life or after death as a result of this chemical action. Dr. Wood has recorded the case of a female, æt. twenty-seven, found dead, whose death had been obviously caused by oxalic acid, but the quantity taken, and the duration of the case, were unknown. The stomach presented, at its upper and fore part near the cardiac opening, an irregular aperture of a size to admit the point of the finger. From this a dark gelatinous-looking matter, resembling coffee-grounds, was escaping in abundance. The perforation was enlarged by removal, and presented the appearance of two large apertures separated by a narrow band. The stomach contained a bloody fluid, in which oxalic acid was detected, and the mucous membrane had an eroded appearance. The small intestines (jejunum and ileum) were similarly affected.

Quantity required to destroy life.—The smallest quantity of this poison which has been known to destroy life was *one drachm* (sixty grains). The boy, æt. sixteen, was a patient of Dr. Barker's, of Bedford. He took the poison in a solid form, and was found in about an hour insensible, pulseless, and his jaws spasmodically closed. He had vomited some bloody matter: his tongue and lips were unusually pale, but there was no excoriation. He died in eight hours. (Lancet, Dec. 1, 1855.) In Mr. Welch's case (suprà) *three drachms* destroyed life in an hour. Two cases occurred at Guy's Hospital, in each of which half an ounce of oxalic acid had been swallowed. Active treatment was adopted, and both patients recovered. When the dose is upwards of half an ounce, death is commonly the result; but one of my pupils informed me of a case in which a man recovered after having taken one ounce of crystallized oxalic acid. Dr. Brush, of Dublin, has communicated to the Lancet a case in which recovery took place after a similar dose of the poison had been taken. (See also a case by Mr. Allison in the same journal, Nov. 2, 1850, p. 502.) The acid was in this instance taken in mistake for Epsom salts.

Period at which death takes place.—Equal quantities of this poison do not destroy life within the same period of time. In two cases, in which about two ounces of the acid were respectively taken, one man died in twenty minutes,—the other in three quarters of an hour. Dr. Christison mentions an instance in which an ounce killed a girl in thirty minutes; and another in which the same quantity destroyed life in *ten minutes*; but in a third case (p. 54) death did not occur until the fifth day. Dr. Ogilvy, of Coventry, has reported a case of poisoning by oxalic acid, in which it is probable that death took place within *three minutes* after the poison had been swallowed. The sister of the deceased had been absent from the room about that period, and on her return found her dying. The *quantity* of poison taken could not be determined. When the dose of oxalic acid is half an ounce and upwards, death commonly takes place in an hour. There are, it must be admitted, numerous exceptions to this rapidity of action. Dr. Christison reports two cases, which did not prove fatal for thirteen hours; and in an instance that occurred to Mr. Fraser, in which only half an ounce was taken, the individual died from the secondary effects in a state of perfect exhaustion, twenty-three days after taking the poison.

Chemical analysis. In the simple state.—This acid may be met with, either as a solid, or in solution in water. *Solid oxalic acid:* It is seen more or less perfectly crystallized in four-sided prisms, in which respect it differs from all other common acids, mineral and vegetable. The crystals are unchangeable in air: they are entirely volatile by heat. They are soluble in water and alcohol, forming a strongly acid solution.

Tests.—1. *Nitrate of silver.*—When added to a solution of oxalic acid, it produces an abundant white precipitate of oxalate of silver. A solution containing so small a quantity of oxalic acid as not to redden litmus-paper, is affected by this test: but when the quantity of poison is small, it would be always advisable to concentrate the liquid by evaporation before applying it. The oxalate of silver is identified by the following properties: 1. It is completely dissolved by cold nitric acid. If collected on a filter, thoroughly dried, and heated on thin platina foil, it is entirely dissipated in a white vapour with a slight detonation. When the oxalate is in small quantity, this detonation may be observed in detached particles on burning the filter previously well dried. 2. *Sulphate of lime.* A solution of oxalic acid is precipitated white by lime water and all the salts of lime. Lime water is itself objectionable as a test, because it is precipitated white by several other acids.

The salt of lime, which, as a test, is open to the least objection, is the *sulphate*. As this is not a very soluble salt, its solution must be added in rather large quantity to the suspected poisonous liquid. A fine white precipitate of oxalate of lime is slowly formed. This precipitate should possess the following properties:—1. It ought to be immediately soluble in nitric acid. 2. It ought not to be dissolved by the tartaric, acetic, or any vegetable acid.

In liquids containing organic matter.—The process is the same, whether it be applied to liquids in which the poison is administered, or to the *matters vomited*, or, lastly, to the *contents of the stomach*. This poison readily combines with albumen and gelatine, and it is not liable to be decomposed or precipitated by these or any other organic substances: it is, therefore, commonly found in solution in the liquid portion, which will then have a greater or less acid reaction. Should the liquid be very acid, we must filter it to separate any insoluble matters; should it not be very acid, the whole may be boiled, if necessary, with distilled water, before filtration is performed. On no account are the tests for oxalic acid to be employed in liquids containing organic matter, since nitrate of silver is easily precipitated by such matters, although none of the poison is present. Should the acid liquid be highly coloured, it may be first boiled for some time with well-washed animal charcoal. After this it may be filtered and concentrated by evaporation. To the filtered liquid, *acetate of lead* should be added until there is no further precipitation; and the white precipitate formed, collected and washed. If any oxalic acid was present in the liquid, it would exist in this precipitate under the form of oxalate of lead. The following plan may be adopted for separating oxalic acid from the oxalate of lead:—Diffuse the precipitate in water, and pass into the liquid for about half an hour a current of sulphuretted hydrogen gas, taking care that the gas comes in contact with every portion of the precipitate. Black sulphuret of lead will be precipitated: and with it commonly the greater part of the organic matter, which may have been mixed with the oxalate of lead. Filter, to separate the sulphuret of lead; the filtered liquid may be clear and highly acid. Concentrate by evaporation; the sulphuretted hydrogen dissolved in the liquid is thereby expelled, and oxalic acid may be ultimately obtained crystallized by slow evaporation in a watch-glass. If there was no oxalic acid in the precipitate, no crystals will be procured on evaporation. If crystals are obtained, they must be dissolved in water, and tested in the manner above directed.

The quantity of this poison found in the stomach is generally small. In one case, in which about an ounce and a half had been taken, and the person died in two hours, I found only thirteen grains. This is owing to the ejection of the greater portion by vomiting. In the case of *Reg.* v. *Cochrane*, (Liverpool Summer Assizes, 1857,) in which it was charged that two children, aged six and four years respectively, had been wilfully poisoned by their mother, it was stated by the medical witness, Dr. Edwards, that he found forty-two grains of oxalic acid in the stomach of the elder, and twenty grains in that of the younger child. It was not clearly established when or how this large quantity of poison could have been administered to the children, and the prisoner was acquitted.

Binoxalate of Potash, or Salt of Sorrel.

Symptoms and effects.—The poisonous effects of this salt entirely depend on the oxalic acid which it contains. It is said to be much used for the purpose of bleaching straw and removing ink stains—being sold under the name of essential salt of lemons. Its poisonous properties are not generally known, or no doubt it would be frequently substituted for oxalic acid. Out of three cases of poisoning by this substance, two proved fatal, while in the other the patient recovered. In the case of recovery, a young lady, aged twenty, swallowed an ounce of the salt dissolved in warm water. She was not seen by any one for an hour and a half: she was then found on the floor, faint and exhausted, having previously vomited considerably. There was great depression, the skin cold and clammy, the pulse feeble, and there was a scalding sensation in the throat and stomach. There was also continued shivering. Proper medical treatment was adopted, and she recovered in two days,—still suffering from debility and great irritation of the stomach. During the state of depression, it was remarked that the conjunctivæ (membranes of the eyes) were much injected, and the pupils dilated. There was also great dimness of vision. (Med. Gaz. vol. 27. p. 480.) In another case, two hundred and twenty-five grains were taken (rather more than half an ounce). Bicarbonate of soda was given as an antidote, and the patient completely recovered. (Med. Times and Gazette, Feb. 12, 1859.) The recovery must have taken place in spite of the antidote,—the oxalate of soda being just as poisonous as the oxalate of potash. For a third case of recovery see the same journal, Oct. 15. 1859, p. 378.

This salt destroys life almost as rapidly as oxalic acid itself: and in the symptoms which it produces it closely resembles that poison. In one case, half an ounce killed an adult in so short a time as *eight minutes*; but probably the fatal effects were in this instance accelerated by the debilitated state of the person who took it. In another case, reported by M. Chevallier, death took place in ten minutes. (Ann. d'Hyg., 1850, vol. 1. p. 162.)

Chemical analysis.—Its solution in water might be readily mistaken for oxalic acid: for, 1st, it has an acid reaction; and 2nd, it is precipitated by nitrate of silver and sulphate of lime, like oxalic acid: but with the latter test the precipitation is much more copious. It is distinguished from oxalic acid—1. By its crystalline form, which, as seen in a few drops evaporated on glass, is prismatic, or plumose; and 2. By heating a portion on platina foil. While oxalic acid is volatile, the binoxalate leaves an ash, which, when sufficiently calcined, is alkaline; and it may be proved to contain potash by its dissolving in diluted nitric acid, with effervescence, and forming nitrate of potash.

TARTARIC ACID.

Symptoms and appearances.—Tartaric acid has not been considered to possess any poisonous properties; but one case has occurred, in which there was no doubt that it acted as an irritant, and destroyed life. The case referred to was the subject of a trial for manslaughter at the Central Criminal Court (*Reg.* v. *Watkins*), in January, 1845. The accused gave the deceased, a man aged twenty-four, by mistake, *one ounce* of tartaric acid instead of aperient salts. The deceased swallowed the whole dissolved in half a pint of warm water at a dose; he immediately exclaimed that he was poisoned; he complained of having a burning sensation in his throat and stomach, as though he had drunk oil of vitriol, and that he could compare it to nothing but being all on fire. Soda and magnesia were administered with diluent drinks. Vomiting set in, and continued until death, which took place nine days afterwards. On inspection, nearly the whole of the alimentary canal was found highly inflamed. The accused admitted that he had made a mistake, and tartaric acid was found in the dregs of the cup. The jury acquitted the prisoner. Another case of poisoning by this acid, with a report of the results of analysis, has been published by M. Devergie. (Ann. d'Hyg. 1851, vol. 2. p. 432.) This case gave rise to a controversy between the late M. Orfila and M. Devergie, the points in dispute relating chiefly to the processes for the detection of the acid in the stomach and tissues. (See Ann. d'Hyg., 1852, vol. 1. p. 199, 382, and vol. 2. p. 230.)

ACETIC ACID.

This acid has been generally excluded from the class of poisons. Common vinegar, which contains only five per cent. of acetic acid, has often been taken in large doses without injurious consequences. From the experiments performed by Orfila on dogs, and from one case which he reports as having occurred in the human subject, acetic acid, when concentrated, appears to exert an irritant action on the body. (Annales d'Hygiène, 1831, vol. 2. p. 159: also Toxicologie, vol. 2. p. 198.) This is not more than we might have expected, seeing that the concentrated acid is highly corrosive. In the case referred to, the deceased, a young female aged nineteen, was found dying on the highway. She suffered from convulsions,—complained of pain in the stomach, and died in a very short time. On inspection, the stomach was found neither softened nor corroded, but its mucous membrane near the pylorus was almost black. The mucous glands were prominent, and the vessels were filled with black coagulated blood.

VINEGAR, which may be regarded as an organic mixture containing but a very small proportion of acetic acid (five per cent.), may be examined by distilling a portion, and testing the distilled liquid for the acid. Vinegar, as it exists in commerce, always contains a small quantity of sulphuric acid, and occasionally traces of arsenic and lead. In general it is easily recognized by its odour. Pelletan observed in the case of a child that the abuse of vinegar led to a thinning of the mucous membrane of the stomach; and Landerer remarked that the milk of a wet-nurse who had been in the habit of taking large quantities of the Vinegar of Roses, became thin, very acid, and deficient in casein and oil. The infant which she was suckling gradually wasted and died, and the woman herself suffered severely. (Heller's Archiv., 1847, 2 H. S. 185.)

CHAPTER 8.

POISONING BY THE ALKALIES.—POTASH, SODA, AND THEIR CARBONATES—SYMPTOMS—FATAL EFFECTS OF THE CARBONATE OF POTASH—APPEARANCES AFTER DEATH—TESTS FOR POTASH AND SODA—AMMONIA AND SESQUICARBONATE OF AMMONIA (SAL VOLATILE)—CHEMICAL ANALYSIS—TESTS FOR AMMONIA.

POTASH AND SODA.

Symptoms.—The symptoms produced by potash and soda, when taken in a large dose, are so similar that one description will serve for both. Cases of alkaline poisoning are extremely rare, and have been, generally, the result of accident. The most common form in which these poisons are met with, is in the state of pearlash (carbonate of potash) and soap-lees (carbonate of soda). The patient experiences, during the act of swallowing, an acrid caustic taste, owing to the alkaline liquid, if sufficiently concentrated, excoriating the mucous membrane. There is a sensation of burning heat in the throat, extending down the gullet to the stomach. Vomiting is not always observed; but when it does occur, the vomited matters are sometimes mixed with blood of a dark brown colour, and with detached portions of mucous membrane:—this effect depending on the degree of causticity in the liquid swallowed. The surface is cold and clammy:—there is purging, with severe pain in the abdomen, resembling colic. The pulse is quick and feeble. In the course of a short time, the lips, tongue, and throat become swollen, soft, and red.

Appearances after death.—In recent cases there are strong marks of the local action of the poison on the mucous membrane of the mouth, throat, and gullet. This membrane has been found softened, detached, and inflamed in patches of a deep chocolate colour,—sometimes almost black. The same appearance has been met with in the mucous membrane of the larynx and windpipe. The stomach has had its mucous surface eroded in patches, and there has been partial inflammation. In one instance as a result of the action of soda, I found it puckered and blackened.

Period of death.—The most rapidly fatal case which I have found reported is that of a boy, who died in *three hours* after swallowing three ounces of a strong solution of carbonate of potash. In a case, which occurred in 1835, a child, aged three years, took a small quantity of pearlash, which had deliquesced, and died in twenty-four hours. Death was caused in this instance by the inflammation induced in the larynx, causing an obstruction to the process of respiration. In this respect, the caustic alkalies may destroy life like the mineral acids. But death may be a slow result of these poisons. Thus in an instance which was communicated to me, a lady swallowed, by mistake, one ounce and a half of the common solution of potash of the shops, which contains about five per cent. of caustic alkali. She recovered from the first symptoms of irritation, but died seven weeks afterwards, from pure exhaustion, becoming greatly emaciated before her death.

Dr. Barclay has reported a case of chronic poisoning by potash, which furnishes a good illustration of the after-effects and appearances caused by this poison. A woman, aged forty-four, was admitted into St. George's Hospital, May 2, 1853, about six hours and a half after she had swallowed a quantity of American potash,—probably a saturated solution of carbonate of potash (American pearlash). She had vomited immediately after taking it. The mouth and throat were much corroded. There was burning pain in the throat and gullet, extending downwards to the stomach; but there was no tenderness on pressure. Two days after her admission there was a little vomiting. The mucous membrane, as far as it could be seen, was abraded; there was difficulty of swallowing, and occasionally pain after food had entered the stomach. In about a month there was frequent vomiting, with pain on pressure, and constipation; when food or medicine was taken, there was much pain in the stomach, and in a short time the food was ejected. As the case progressed nothing could be retained on the stomach, and shortly before death the patient was supported only by nutritive injections. She died from starvation on the 8th July, about two months after taking the alkali. On inspection the lower part of the gullet was found much contracted, the lining membrane entirely destroyed, and the muscular coat exposed. The external coats were much thickened. The cardiac orifice of the stomach, where the ulceration ceased, was considerably contracted. At the pyloric end, the mucous lining presented a large and dense cicatrix, obstructing all communication with the duodenum except by an orifice no larger than a probe. The intervening portion of the stomach was healthy, as were also the large and small intestines. (Med. Times and Gazette, Nov. 26. 1853, p. 554.)

Orfila refers to two cases of poisoning by carbonate of potash, in each of which half an ounce of this substance was taken by mistake for aperient salts. The patients, two young men, recovered from the first effects, but ultimately died: the one three months, and the other four months, after the poison had been taken. The secondary fatal effects appear to be due to constant purging, great irritability of the stomach leading to incessant vomiting, or loss of the functions of this organ from the destruction of the lining membrane, and stricture either of the gullet or of the apertures of the stomach,—any of which causes may prove fatal at almost any period. A fatal case of stricture, produced by soap-lees after the lapse of two years and three months, is reported by Dr. Basham (Lancet, March 2. 1850). The constant use of the alkalies or their carbonates appears to be productive of latent mischief: yet the quantity which may be sometimes taken in divided doses without destroying life is enormous. Dr. Tunstall, of Bath, relates the case of a man who, for eighteen years had been in the habit of taking bicarbonate of soda to remove dyspepsia. It is stated that for sixteen years he took *two ounces* of the bicarbonate daily! The man died suddenly, and on examining the stomach it was found to be greatly distended and extensively diseased, — conditions which were referred by Dr. Tunstall to the action of the carbonate of soda. (Med. Times, Nov. 30, 1850, p. 564.) The *quantity* of any of these alkaline poisons required to destroy life is unknown.

Chemical analysis.—Solutions of Potash and Soda are known from those of their respective carbonates by giving brown precipitates with a solution of nitrate of silver. The Carbonates, on the other hand, yield a whitish-yellow precipitate. Potash is known from Soda by the following characters:—1. Its solution, when not too much diluted with water, is precipitated of a canary-yellow colour by perchloride of platina. 2. It is precipitated in granular white crystals, on adding the alkaline liquid gradually to a strong solution of tartaric acid, and occasionally stirring the mixture, or by suspending in it a large crystal of tartaric acid. SODA is not precipitated by either of these tests, which will serve equally to distinguish the *salts of potash* from those of soda, if we except the binoxalate and bitartrate of potash: these, from being but little soluble in water, are not precipitated. 3. If we neutralize the two alkalies by diluted nitric acid, and crystallize the liquid on a slip of glass,—should the alkali be potash, the crystals will have the form of long slender fluted prisms; if soda, of rhombic plates. 4. Potash and its salts are known by their giving a violet colour, while soda and its salts give a bright yellow colour, to the flame of alcohol.

In liquids containing organic matter.—Such liquids are frothy; they possess an alkaline reaction, a peculiar alkaline odour, and are soapy to the feel. The organic liquid may be evaporated to dryness, then heated to char the animal and vegetable matter, and the alkali will be recovered from it in a state of carbonate, by digesting the residuary ash in distilled water.

AMMONIA. SPIRIT OF HARTSHORN.

The *vapour* of strong ammonia is poisonous. It may destroy life by producing violent inflammation of the larynx, or by causing pneumonia. It is often most injudiciously employed to rouse persons from a fit. A case is on record of an epileptic having died under all the symptoms of croup, two days after the application of strong ammonia to the nostrils. A singular case of recovery from the poisonous effects of this vapour, by Dr. Sanchard, will be found reported in the Annales d'Hygiène (Janvier 1841).

Symptoms.—The strong *solution* of ammonia produces symptoms similar to those described in speaking of potash. The only difference observed is, that the sense of heat and burning pain in the throat, gullet, and stomach, is much greater. Cases of this form of poisoning are rare. Dr. Sanchard relates an instance that occurred in France, in which a boy, only six years old, poisoned his younger sister by pouring several teaspoonfuls of a strong solution of ammonia down her throat. A case is likewise reported, in which a strong dose of the solution killed a man in *four minutes.* (Christison, 167.) Another case is referred to in the Journal de Pharmacie (Oct. 1846, p. 285), in which from one to two drachms of ammonia, unknowingly administered, caused death. There was violent vomiting, with bloody stools; and, on inspection, blood was found effused in the intestines. There was also a remarkably fluid state of the blood in the body. In another instance, a man walked into a druggist's shop, and asked for a small quantity of ammonia to take spots out of his clothes. The druggist poured about a teaspoonful and a-half into a glass. The man suddenly swallowed it, and fell instantly to the ground. He soon afterwards died, complaining of the most excruciating pain. (Journal de Chimie Médicale, 1845, 531.) A similar case occurred at Halifax in April 1857:—a man swallowed a large dose of ammonia, and died in a quarter of an hour.

Serious injury to the organs of respiration is sometimes the result of the action of this poison, as in the following case, which was referred to me for examination by my colleague, Mr. Hilton, in May 1857. A gentleman liable to attacks of fainting died in three days, after swallowing a quantity of a liquid administered to him by his son. This liquid, which was at the time believed to be sal volatile, was, in fact, a strong solution of ammonia. The deceased complained immediately of a sensation of choking and strangling in the act of vomiting. Symptoms of difficulty of breathing set in, with other signs of irritation in the throat and stomach. The mucous membrane of the mouth and throat was corroded and dissolved: and it was evident that the liquid had caused great local irritation. The difficulty of breathing was such as to threaten suffocation, and at one time it was thought that an operation must be resorted to. The state of the patient, however, precluded its performance, and he died on the third day. On *inspection*, the viscera presented strong marks of corrosion. The covering of the tongue was softened, and had peeled off: the lining membrane of the air-passages was softened and covered with layers of false membrane, the result of inflammation,—the larger bronchial tubes were completely obstructed by casts or cylinders of this membrane. The lining membrane of the gullet was softened, and at the lower part near its junction with the stomach, the tube was completely dissolved and destroyed. There was an aperture in the stomach in its anterior wall, about one inch and a half in diameter: the edges were soft, ragged, and blackened, presenting an appearance of solution. The contents of the stomach had escaped. On the inside, the vessels were injected with dark-coloured blood, and there were numerous small effusions of blood in various parts of the mucous membrane. The coats were thinned and softened at the seat of the aperture. The blackened and congested appearance somewhat resembled that which is seen in poisoning by sulphuric or oxalic acid. The mucous matter on the coats of the stomach was feebly acid. No poison of any kind was found in the layer of mucus or in the coats. There was not in any part the slightest trace of ammonia, the poison which had caused the mischief. The deceased had lived three days: remedies had been used, and every trace of ammonia had disappeared. The immediate cause of death was an obstruction of the air tubes, as a result of inflammation, caused by the local irritant action of the poison. It was quite obvious that a quantity of the liquid had entered the windpipe. The perforation of the stomach had probably taken place shortly before death, or there would have been marks of peritonitis. The injury to the stomach and gullet would have been sufficient to cause death, even supposing that the liquid had not penetrated to the lungs.

Mr. Tyerman communicated to me the particulars of a case which occurred in Nov. 1858, in which a lunatic, æt. sixty-two, swallowed about two fluid ounces of compound camphor liniment. The patient immediately complained of great heat in the stomach; vomiting was induced by giving to him warm water. The uvula, throat, and gullet were so intensely inflamed that he had lost all power of swallowing; and the efforts to swallow liquids produced violent retching. The symptoms gradually abated, and the man recovered in four days. In this case the quantity of ammonia swallowed was small, amounting to about two and a half drachms, diluted with about six times the quantity of rectified spirits. In the Medical Times and Gazette for May 26, 1855, there are two cases reported, in which children were poisoned by swallowing a liniment of ammonia and oil. In one, an infant, died speedily, probably from œdema and closure of the glottis. In the other case, death took place on the following morning. These cases prove that oil does not counteract the effects of alkaline poisons. Considering the hot taste of ammonia, it is remarkable that an infant could have had the power of swallowing nearly two ounces of strong ammoniacal liniment. It had been poured down its throat by another child of five years of age.

Carbonate of ammonia.—The solution of this salt (sal volatile) is probably more active as a poison than is commonly supposed. The following case occurred to my knowledge in 1832. A man, in a fit of passion, swallowed about five fluid-drachms of a solution of sal volatile. In ten minutes, he was seized with stupor and insensibility; but upon the application of stimulant remedies he recovered. He suffered for some time afterwards, from severe irritation about the throat and gullet. Mr. Iliff, jun., has reported the case of a little boy, aged two years, who swallowed about half an ounce of strong solution of spirits of hartshorn, and in spite of rather severe symptoms recovered in a few days. (Lancet, Dec. 1, 1849.)

In a paper above referred to (p. 63), Dr. Barclay relates the case of a female, æt. nineteen, who, while in a state of unconsciousness, was made to swallow a quantity of hartshorn. She felt a severe pain in the stomach immediately afterwards, and in about an hour she vomited some blood. This vomiting of blood continued for several days. These symptoms were followed by great irritability of the stomach, and the constant rejection of food. There was obstinate constipation of the bowels, with great emaciation and loss of strength. She died in about three months from the time at which she had swallowed the alkaline poison. On inspection, the gullet was found healthy; the orifice, at its junction with the stomach, was slightly contracted. The pyloric orifice was contracted to the size of a crowquill, and the coats were thickened. On the posterior wall of the stomach, there was a dense cicatrix of the size of half a crown, and from this point fibrous bands ramified in various directions. The duodenum and other parts of the intestinal canal were healthy. (Med. Times and Gazette, Nov. 26, 1853, p. 554.) A case occurred to Mr. Procter, in May, 1852, in which a woman gave to her infant, four weeks old, a teaspoonful of hartshorn of the strength of about nine per cent. The child became more and more depressed, and died thirty-six hours after taking the liquid. There was no vomiting or purging, and the mouth and throat presented no excoriation: there was, however, slightly increased redness of the lining membrane. An examination after death was not made.

The salts of ammonia are not often used by persons who are intent upon suicide or murder, but there is one instance on record in which a man was tried for the murder of a child by administering to it spirits of hartshorn. (*Regina* v. *Haydon*, Somerset Spring Assizes, 1845.) Of the action of the other compounds of ammonia on man, nothing is known.

Chemical analysis.—The three alkalies, potash, soda, and ammonia, are known from the solutions of the *alkaline earths* by the fact that they are not precipitated by a solution of carbonate of potash. They all three possess a powerful alkaline reaction on test paper, which, in the case of ammonia, is easily dissipated by heat. Ammonia is immediately known from potash and soda by its odour and volatility. The CARBONATE OF AMMONIA may be known from other salts by its alkaline reaction, its odour, and its entire volatility as a solid:—from pure ammonia—1, by its effervescing on being added to an acid; 2, by its yielding an abundant white precipitate with a solution of chloride of calcium:—from the carbonates of potash and soda, among other properties.—1, by its giving no precipitate with a solution of the sulphate of magnesia; 2, from the rich violet blue solution which it forms when added in excess to the sulphate of copper; 3, by its odour and volatility.

CHAPTER 9.

PHOSPHORUS—SYMPTOMS AND APPEARANCES—CHRONIC POISONING BY THE VAPOUR — FATAL DOSE—CHEMICAL ANALYSIS — PHOSPHORUS-PASTE — RED OR AMORPHOUS PHOSPHORUS.

PHOSPHORUS.

CASES of poisoning by phosphorus appear to have been much more numerous in France than in England. M. Chevallier has collected seventy-four cases of poisoning by this substance, and in forty-two of these, the phosphorus was procured from lucifer matches. Among the cases, twenty-five were the result of accident, twenty-eight involved a criminal charge, and twenty-one were the result of suicide. (Ann. d'Hygiène, 1857, vol. 2. p. 226.) The cases of poisoning by phosphorus in this country are not numerous. They are chiefly referable to accident or suicide. One trial for the criminal administration of phosphorus took place at the Bodmin Autumn Assizes, 1857, in which there was no doubt that death had been caused by phosphorus-paste.

Symptoms.—Phosphorus acts as an irritant poison, but its operation is attended with some uncertainty, according to the state in which it is taken. The symptoms are frequently slow in appearing: it is only after some hours, and sometimes even one or two days, that signs of irritation with convulsions and spasms appear; but when these once come on, the case proceeds rapidly to a fatal termination. In the first instance the patient experiences a disagreeable taste resembling garlic, which is peculiar to this poison. An alliaceous or garlic odour may be perceived in the breath. There is an acrid burning sensation in the throat, with intense thirst, nausea, severe pain and heat with a pricking sensation in the stomach, followed by distension of the abdomen and frequent vomiting. The vomited matters are of a dark green or black colour; they have the odour of garlic, white vapours may be seen to proceed from them, and in the dark they may even appear phosphorescent. Purging has been noticed among the symptoms, and the motions have been observed to be luminous in the dark. The pulse is small, frequent, and scarcely perceptible. There is great prostration of strength, and coldness of the skin with other symptoms of collapse. The patient may die quietly, or be convulsed before death.

A woman, æt. twenty-six, swallowed a decoction of lucifer matches in coffee. In an hour an emetic was given to her, and she vomited half a pint of clear glairy fluid, having the smell of phosphorus, and being intermixed with particles of blue colouring matter, from the matches. She had no pain in the stomach, and no purging. In four days she appeared to have recovered; but about this time there was bleeding from the nose; she was jaundiced, and blood appeared in the matter vomited. Febrile symptoms set in with purpura, and she died in about a week after taking the poison. (Ed. Monthly Journal, Oct. 1860.)

Phosphorus vapour. Chronic poisoning.—Chronic poisoning by phosphorus is accompanied by nauseous eructations, frequent vomiting, sense of heat in the stomach, purging, straining, pains in the joints, wasting, hectic fever, and disease of the stomach, under which the patient slowly sinks. Some interest is attached to the chronic form of poisoning by phosphorus from the researches of Dr. Strohl and others on the effects of the *vapour* upon individuals engaged in the manufacture of phosphorus or lucifer matches. It has been remarked that persons thus engaged have suffered from necrosis of the jaw, carious teeth, and abscesses. There has been also marked irritation of the respiratory organs, and bronchitis has frequently shown itself among them. These effects have been attributed to the respiration of the vapours of phosphorus, which are supposed, in becoming acidified, to act chemically upon the bones. (See ON POISONS, p. 345.)

Appearances.—Among the appearances produced by this poison, we may be prepared to find marks of irritation and inflammation in the stomach and intestines. The stomach has been observed to be much contracted: and the mucous membrane inflamed, occasionally softened and presenting purple or violet-coloured spots. Inflammation of the stomach and bowels proceeding to gangrene may be a result of the action of phosphorus. M. Worbe found the stomach perforated in three places in a dog which had been poisoned by a solution of phosphorus in oil. A man, æt. fifty, took a quantity of phosphorus-paste used for destroying vermin. He was seen in his usual health at twelve o'clock P.M., and was found dead in a field the following morning. On inspection, it was observed that there was great muscular rigidity. The membranes of the brain were much congested, and there was serous effusion between them. The substance of the brain was also congested. The heart was flaccid and nearly empty. The mucous membrane of the stomach, gullet, and small intestines was very red, and there were patches in which the membrane was destroyed. On opening the stomach a white smoke escaped, accompanied by a strong smell of phosphorus. It contained a table-spoonful of viscid greenish matter, from which particles of phosphorus with some Prussian blue (used as a colouring for the poison), subsided on standing. (Dr. Bingley, Lancet, June 13, 1857, p. 600.) Mr. Herapath states that in a case which he examined he found, besides inflammation of the stomach, the mucous membrane raised in small bladders or vesications. This was probably a change produced by putrefaction, as the body was not examined until twenty-three days after death. Such a blistered appearance is frequently seen in cadaveric inspections, and has not been observed in other cases of poisoning by phosphorus. Schuchardt describes, among the appearances, fluidity of the blood, which is of a dark colour, and does not become red on exposure to the air. Ecchymoses are sometimes found on the skin and on the surface of various organs. (Brit. and For. Med. Rev. 1857, vol. 19. p. 506. Journal de Chimie Médicale, 1857, p. 84.)

In the case of the female described at page 69, who died after the lapse of a week, there was no inflammation, ulceration, or softening of the mouth, gullet, stomach, or small intestines. There was a red patch in the cæcum and another in the colon. The contents of the stomach and intestines had a coffee-ground colour, like the liquid found in hæmatemesis. The brain was slightly congested. There were bloody effusions in the chest and abdomen, and an apoplectic condition of the soft organs. The vomited matters, when shaken in the dark, were phosphorescent, and phosphorus was separated from them by sulphide of carbon.

The viscera, and even the flesh of animals recently poisoned by phosphorus, have the odour of garlic, and appear luminous in the dark. (Galtier, Toxicologie, vol. 1. p. 184.) Mr. Clowes informed me, that in examining some fowls which had been poisoned with phosphorus, he was struck with the strong odour of this substance on opening the gizzards, and with the appearance of a fine white fume, which was luminous when observed in a dark room. In the case of a woman who died while taking phosphorus medicinally, it was remarked that the whole of the viscera of the body were luminous; thus indicating the extensive diffusion of the poison by absorption. (Casper's Wochenschrift, 21 and 28 Feb. 1846, 115, 135.) For a further account of the appearances, see Chemist, Jan. 1856, p. 244.

Fatal dose.—That phosphorus is a powerful poison, is proved by two cases quoted by Dr. Christison. In one, death was caused by a grain and a half in twelve days; in the other, by two grains in about eight days. It is supposed to operate as a poison only by becoming converted to phosphorous acid; but although this conversion takes place, it is probable that it passes directly into the blood, since the urine passed during life has been observed to be luminous. The production of phosphorous acid may account for the erosions met with in the stomach and bowels.

Dr. Hartcop mentions that an apothecary took by way of experiment one grain,—the next day two grains, and the third day three grains of phosphorus mixed with sugar. He was then seized with inflammation of the stomach and bowels, and died in spite of every attempt to save him. (Casper's Wochenschrift, 1846, p. 117.) M. Chevallier refers to a case in which a dose of 2·3 grains proved fatal, and two other cases in each of which a dose of 4·6 grains destroyed life. The same writer quotes, on the authority of Löbenstein Löbel of Jena, the case of a lunatic who died from a dose of one-eighth of a grain. (Ann. d'Hyg. 1857, vol. 1. p. 422.) Excepting this, the smallest fatal dose which I have met with, is in a case quoted by Galtier. A woman, æt. fifty-two, took in divided doses, in four days, about six centigrammes, or less than *one grain*, of phosphorus dissolved. The largest dose taken at once, *i.e.* on the fourth day, is stated to have been three centigrammes (0·462 grain), or less than half a grain. Symptoms of pain and irritation appeared, and the patient died in three days. The gullet, stomach, and small intestines, were found much inflamed. (Toxicologie, vol. 1. p. 87.) When the phosphorus is dissolved in any liquid, or when it is finely divided, as in phosphorus-paste or in lucifer matches, its action is then more powerful, as it is in a state well fitted for absorption.

The earliest period at which death has taken place is *four hours*. This was in a case related by Orfila, of a young man in weak health, who took a dose of this poison. The same author mentions a case in which death did not take place until after the lapse of seventeen days. In general, several days elapse before a fatal result takes place, and during this time the patient undergoes much suffering. This was observed in a young female who swallowed a quantity of phosphorus-paste intended for poisoning rats. She did not die until the fifth day. (Journal de Chimie Méd. 1845, 580.)

Chemical analysis.—Phosphorus is a solid of waxy consistency, having a peculiar odour and taste resembling garlic. It is the odour and taste which prevent it from being criminally employed as a poison, and render it easy of detection in articles of food. It evolves a white vapour in daylight, and a faint bluish luminosity in the dark. It melts and takes fire at a temperature a little above 100°, burning with a bright yellow flame, and producing thick white acid vapours by combustion. It is not soluble in water, but water in which it has been preserved or washed, acquires poisonous properties by reason of the phosphorous acid formed. (Ann. d'Hyg. 1857, vol. 1. p. 423.) It is soluble in alcohol and the oils, but especially in ether, sulphide of carbon, and chloroform.

Organic mixtures.—The smell which phosphorus imparts to organic substances is remarkably characteristic and persistent. When it has been taken in a solid form it may be separated as a sediment in fine particles by washing the contents of the stomach in water. If a portion of the organic liquid be exposed in the dark, the particles of phosphorus will be known by their luminosity, as well as their combustion, when the surface on which the material is spread, is heated. Phosphorus is very soluble in sulphide of carbon, and it may be easily separated from organic matters by digestion with this liquid. On the spontaneous evaporation of the sulphide, decanted from the organic liquid or solid, the phosphorus may be procured in small globules or beads. The phosphorus thus obtained sometimes takes fire spontaneously, and burns with its well-known flame.

Phosphorus gives off no luminous vapour when alcohol or ether is present; but the process suggested by Mitscherlich for the detection of small quantities is not exposed to this difficulty. Mitscherlich adds to the organic substance a sufficiency of water to make it quite fluid, and a small quantity of sulphuric acid. This mixture is placed in a flask, connected with a long glass condensing tube, placed vertically and kept cool by a stream of cold water. The tube is fitted into a receiver. The suspected liquid is distilled in the dark, and if a minute trace of phosphorus be present,—1-100,000th part, or, according to De Vrij, 1-200,000th, the fact will be made evident by a luminous appearance in the upper part of the tube, at each successive condensation of the vapours. (See Otto, Ausmittelung der Gifte, 1856, p. 78.) If ether or alcohol should be present, the vapours of these liquids are distilled over first. (Die Vergiftungen, Böcker, 1857, p. 83.) In the receiver in which the vapour of the distilled liquid is condensed, phosphorus or phosphoric acid may be discovered by the usual tests. There can be no doubt of the facility and delicacy with which phosphorus thus admits of detection. In a case which occurred to Mr. Herapath, this chemist failed to detect any trace of phosphorus in a body on the twenty-third day after death: hence, like other poisons, it is liable to disappear. Phosphorus sometimes contains arsenic: hence traces of this poison may occasionally be found. (Med. Gaz., vol. 35. page 655.)

Red or *Amorphous Phosphorus.*—The remarkable substance, known under the name of allotropic phosphorus, is not possessed of poisonous properties. This fact, long since announced by Liebig (Letters on Chemistry, 165), has been confirmed by experiments at the Veterinary College of Alfort. (Ann. d'Hyg. 1857, vol. 1. p. 432.) Common phosphorus is poisonous in doses varying from one to three grains, while amorphous phosphorus has been given to animals in doses of thirty-one grains without causing symptoms of poisoning. The amorphous phosphorus, by reason of its being in a fine powder, is in a state more favourable for acting as a poison than common phosphorus, and yet it is inert! M. Bussy in 1850, and M. de Vrij in 1851, proved that a dog might take with impunity thirty grains. Orfila and Rigaut have given it to animals in doses amounting to some ounces, over a period of twelve days, without producing any noxious effects. (See Annuaire de Thérapeutique, 1855, p. 103.) That it does not act as a poison in the human body, appears to be established by the facts of a case reported in the Edinburgh Monthly Journal for October, 1860. A woman, æt. twenty-six, swallowed the composition scraped from a number of lucifer matches: it turned out that these were made with red or amorphous phosphorus. She suffered no inconvenience. She procured other matches of common phosphorus, took a decoction of them in coffee; and she died from the effects.

Considering that this body is simply phosphorus in an altered physical state, and that it is again changed to common phosphorus when heated to a high temperature, we have here the instance of the same substance being poisonous in one molecular condition, and not poisonous in another! This is probably to be explained by the great insolubility of red phosphorus, and by the fact that it is not readily convertible to phosphorous acid. Red phosphorus is easily known by heating it in air to about 500°, when it burns like common phosphorus. It is insoluble in all liquids, and by its insolubility in sulphide of carbon it is distinguished and separated from common phosphorus. It is not luminous in the dark, unless it contains common phosphorus. In any analysis for phosphorus, we must take care to exclude it by employing sulphide of carbon as a solvent for the common or poisonous form of phosphorus. (The reader will find a full account of the comparative effects of the common and red phosphorus by M. Chevallier in the Annales d'Hygiène, 1856, vol. 1. p. 374.) See also the same journal, 1859, vol. 2. p. 370, and Casper's Vierteljahrsch, 1860, vol. 2. p. 185.

CHAPTER 10.

METALLIC IRRITANT POISONS. ARSENIC — ARSENIOUS ACID — TASTE — SYMPTOMS — CHRONIC POISONING — APPEARANCES AFTER DEATH — QUANTITY REQUIRED TO DESTROY LIFE. — PERIOD AT WHICH DEATH TAKES PLACE — CHEMICAL ANALYSIS — TESTS FOR ARSENIC — MARSH'S PROCESS — REINSCH'S PROCESS.

White Arsenic. Arsenious Acid.

The term White Arsenic is commonly applied to the arsenious acid of chemists. It is seen under the form of a white powder, or in opaque masses resembling enamel. It is called an acid from its power of combining with alkalies, but it possesses a feeble acid reaction when dissolved in water. It is often described as having an *acrid taste*, but this does not appear to be correct; a small quantity of it has certainly no appreciable taste, a fact which may be established by direct experiment, and might be inferred from its sparing solubility in liquids. It would appear from numerous cases on record, that it has been unconsciously taken in fatal quantities, in all descriptions of food, without exciting the least sensation on the tongue. Most of those persons who have been criminally or accidentally destroyed by arsenic, have not been aware of any taste in taking the poisoned substance. In cases in which the powder has been taken in *large* quantity, it is described as having had a *roughish* taste.

The *solubility* of this substance in liquids is a frequent question on trials. The action of water is materially influenced by circumstances. I have found by numerous experiments (Guy's Hospital Reports, No. 4, p. 81), that hot water in cooling from 212° on the poison in fine powder dissolves about the 400th part of its weight. This is in the proportion of nearly one grain and a quarter of white arsenic to about one fluid-ounce of water. Water boiled for an hour on the poison and allowed to cool, holds dissolved the 40th part of its weight, or about twelve grains in one ounce. If boiled for a shorter time not more than 1-80th part will be dissolved. Cold water allowed to stand for many hours on the poison does not dissolve more than from the 1000th to the 500th part of its weight; *i. e.*, one half grain to one grain of arsenic to nearly one fluid-ounce of water. The presence of organic matter in a liquid renders the poison much less soluble.

Symptoms.—These will vary according to the form and dose in which the poison has been administered. The time at which they come on is generally in from half an hour to an hour after the poison has been swallowed. This is the average period. I have known them to appear in a quarter of an hour. Dr. Christison mentions one instance in which the symptoms began in eight minutes; but in the case of *Lofthouse*, tried at the York Lent Assizes, 1835, the symptoms were proved to have attacked the deceased while he was in the act of eating the cake in which the poison was administered. On the other hand, in an instance communicated to me by Mr. Todd, where one drachm had been taken on an empty stomach, no symptoms appeared for two hours; in a case reported by Orfila, the symptoms did not show themselves for five hours; and in another that occurred to Dr. Lachèse, in which a large dose was taken, the symptoms did not come on for seven hours. (Ann. d'Hyg. 1837, vol. 1. p. 344.) Dr. Thompson, of Liverpool, states that he met with a case in which from thirty to forty grains of arsenious acid, and the same quantity of chrome yellow were taken. Symptoms of poisoning did not appear until five or six hours afterwards. Arsenic was detected in the urine. The person recovered in three weeks. (Med. Chir. Rev., Jan. 1854, p. 294.) There may be every variety between these extremes. In one case their appearance was protracted for *ten* hours—the maximum period yet known. A remarkable instance occurred to M. Tonnelier, in which the poison was taken by a young female at eleven o'clock in the morning, and no well-marked symptoms occurred for *eight hours*: there was then violent vomiting. After death, a cyst, formed of mucous membrane and containing arsenic, was found in the stomach: the poison having thus become sheathed over! (Flandin, vol. 1, p. 535.) In a case communicated by Mr. Clegg to the Medical Times (Oct. 21, 1848), symptoms of violent irritation did not show themselves until twenty-three hours after the poison had been taken, and within about half an hour of the death of the patient. The girl was once sick shortly after having taken the poison, but the first symptoms were those of narcotism. The girl was a confirmed opium-eater, and this habit may in some measure have influenced the operation of the poison. From a case communicated to the Medical Gazette by Dr. W. Burke Ryan (vol. 47, p. 722), it appears that the active symptoms of irritation which commonly attend arsenical poisoning, may not appear until after the lapse of *nine hours* from the time at which the poison has been swallowed. With the exception of one case recorded in my work ON POISONS (ARSENIC) in which the interval was ten hours, this is the longest period of protraction on record. In other instances there have been great intermissions. In all cases in which arsenic enters the system from without, as by its application to the skin, or to ulcerated or diseased surfaces, the symptoms are rarely manifested until after the lapse of several hours.

The individual first experiences faintness, depression, nausea, and sickness, with an intense burning pain in the region of the stomach, increased by pressure. The pain in the abdomen becomes more and more severe: and there is violent vomiting of a brown turbid matter, mixed with mucus, and sometimes streaked with blood. These symptoms are followed by purging, which is more or less violent, and this is accompanied by severe cramps in the calves of the legs. The matters discharged from the stomach and bowels have had in some instances a yellowish colour, as it was supposed, from a partial conversion of the poison to sulphuret, but more probably from an admixture of bile. The vomited matters are in some cases coloured by blood, —and the mixture of blood with bile has often given to them a green or brown colour. In other cases, they may consist of a large quantity of mucus ejected in a flaky state and having a milky-white appearance, as if from the admixture of white arsenic. The *colour* of the vomited matters has been hitherto much relied on as an aid to diagnosis; but it is necessary to direct the attention of practitioners to the probable effect of the law on the sale of arsenic (14 Vic. cap. 13. sec. 3) in completely changing the appearance of the matters vomited by a person labouring under the effects of this poison. The sale of white arsenic in any quantity less than ten pounds is prohibited, unless it is mixed with 1-16th part of its weight of soot, or 1-32d part of its weight of indigo. The vomited matters may therefore be blue or black,—or the admixture of bile may render them of a deep green colour. In a case of arsenical poisoning communicated to me by Dr. Maclagan, the *blue* vomiting at first completely misled those who were called to render assistance. The vomiting is in general violent and incessant, and is excited by any liquid or solid taken into the stomach. There is tenesmus (straining), and the discharges by the bowels are frequently tinged with blood. There is a sense of constriction, with a feeling of burning heat in the throat, commonly accompanied by the most intense thirst. The pulse is small, very frequent, and irregular; sometimes wholly imperceptible. The skin is cold and clammy in the stage of collapse; at other times it is very hot. The respiration is painful from the tender state of the abdomen. Before death, stupor sometimes supervenes, with paralysis, tetanic convulsions, or spasms in the muscles of the extremities. In one instance trismus (lock-jaw) appeared in three quarters of an hour. (Orfila, vol. 1. p. 449.)

Chronic poisoning.—Should the person recover from the first effects, and the case be protracted, or should the dose have been small and administered at intervals, there will be inflammation of the conjunctivæ, with suffusion of the eyes, and intolerance of light;—a condition which is, however, often present with the early symptoms above described. In a case reported by Mr. Jeffreys, an adult female died in three hours after taking arsenic in a pudding served at dinner. There was no vomiting or purging. In two hours she was in a state of complete collapse, and at this time it was noticed that the conjunctivæ (the membranes of the eyes) were red. (Med. Times, Aug. 30, 1851, p. 229.) There is also irritation of the skin, accompanied by a vesicular eruption, which has been called eczema arsenicale. Sometimes this has assumed the form of nettle-rash or of the eruption attending scarlet fever, for which disease arsenical poisoning has been mistaken. Local paralysis, preceded by numbness or tingling in the fingers and toes, and other symptoms of nervous disorder, are also common consequences. Exfoliation of the cuticle and skin of the tongue, with the falling off of the hair, has likewise been witnessed. (Case of the *Turners*, 1815, Marshall, 119.) Salivation has been observed to follow, especially when small doses of the poison have been given for a length of time. (Med. Gaz. vol. 16. p. 790.) Strangury and jaundice have been noticed among the secondary symptoms. (Marshall on Arsenic, 44, 111.) A well-marked case of *slow poisoning* by arsenic is recorded by Flandin. (Traité des Poisons, ou Toxicologie, tom. 1. p. 510.) It illustrates a not unfrequent form of *secret* murder, and it is well calculated to inspire caution in making a diagnosis from symptoms. A woman put daily into the soup of her fellow-servant, a very small quantity of arsenious acid in powder. Shortly after dinner this person was seized with vomiting, which led to the rejection of the food and poison before the latter had caused any serious mischief. As this practice was continued at intervals for about six weeks, the stomach became exceedingly irritable; there was pain in the bowels, and the woman was much emaciated. There was also spitting of blood, with such a degree of nervous irritability, that a current of air falling upon her, caused an attack of spasms and convulsions. When the patient found that she could not bear any thing on her stomach, she left the place and passed two months in the country. Her health became gradually re-established there, and she returned to resume her usual occupations. The prisoner, however, renewed her attempts; and to make sure of destroying life, gave her one morning in coffee, a strong dose of arsenious acid in powder: violent vomiting ensued, and the poison was expelled with the food taken at breakfast. Arsenic was detected in the vomited matter, and the explanation of the cause of the long previous illness then became clear. Under proper treatment the patient recovered. I believe this mode of poisoning to be more frequent in this country than is commonly supposed: and it behoves practitioners to be exceedingly guarded in their opinions, for the usual characters of arsenical poisoning are completely masked. (See page 21.) The case of *Mrs. Wooler* (Durham Winter Assizes, 1855) conveys an important lesson in this respect. The suspicions of the medical attendants were confirmed, but at too late a period to save the life of the lady. The symptoms may be easily referred to chronic inflammation, or ulceration of the stomach from natural causes, leading to perforation. Some years since I was required to examine a case like that of *Wooler*, in which the death of a person had been caused by his housekeeper under somewhat similar circumstances. The crime was not discovered until after the lapse of two years: and from the small dose given, and repeated vomiting during life, no arsenic could be detected in the body. There are many anomalous cases on record, in which the symptoms have diverged so much from the ordinary course as to embarrass medical practitioners. For some of these, I must refer to a paper by Dr. Ogston, Med. Gaz. vol 47, p. 181: also to my work On Poisons, p. 364.

There is one form of chronic poisoning by arsenic on which it will be proper to make a few remarks, as the real cause may remain wholly unsuspected. Arsenic is largely employed in this country, under the form of Scheele's green or arsenite of copper, in the manufacture of decorative papers with which the walls of sitting and bed rooms are covered. Some persons have suffered from dry cough, headache, irritation of the throat and eyes, and other symptoms of chronic poisoning by arsenic, in which no other cause was apparent than the continued respiration of the air of their rooms, charged probably at times with a fine arsenical dust. On examining the papers, I have found them in some instances loaded with arsenic, laid on in a rough and coarse manner, so as to be easily removed by friction. Arsenic is thus used in imparting a green tint to some of the most costly as well as the cheapest decorative papers. It is a practice fraught with danger in more respects than one, and under a proper system of medical police it would not be permitted. In the kingdom of Prussia, the use of these papers is strictly prohibited. If there has not hitherto been much complaint on the subject, it may be attributed to the fact that the real cause of the illness has been mistaken, or has not been suspected. Many obscure cases of illness, referred at the time to constitutional or other causes, may probably have been due to the effects of arsenical dust thus inhaled day and night by those who inhabited the rooms. Dr. Hinds has described two cases in which the prominent symptoms were prostration of strength, head-ache, thirst, loss of appetite—an inflammatory state of the conjunctivæ with heat and dryness of the fauces. (Med. Times and Gazette, May 23, 1857, p. 521; Lancet, 1857, vol. 1, p. 193.) A portion of the paper of the room in which these persons lived was sent to me, and on examination I found in the green pigment spread over it, a large quantity of arsenic. These facts should be borne in mind in cases in which it is suspected that poison is being secretly administered to another.

Appearances after death.—The striking changes produced by arsenic are generally confined to the stomach and bowels. They are commonly well marked in proportion to the largeness of the dose and the length of time which the individual has survived after taking the poison. Our attention must be first directed to the *stomach.* Arsenic seems to have a specific effect on this organ: for, however the poison may have entered into the system—whether through a wounded or ulcerated surface, or by the act of swallowing—the stomach has been found inflamed. This inflammation cannot, then, be always dependent on the local irritant action of the poison. The mucous membrane of the stomach, which is often covered with a layer of mucus, mixed with blood, and with a white pasty-looking substance containing arsenic, is commonly found red and inflamed in dotted or striated patches:—the colour, which is of a dull or brownish red, becomes brighter on exposure to the air:

at other times it is of a deep crimson hue, interspersed with black-looking lines or patches of altered blood. The redness is usually most strongly marked at the greater extremity; in one case it may be found spread over the whole mucous surface, giving to it the appearance of red velvet; in another it will be chiefly seen on the prominences of the rugæ or folds. The stomach has been found highly inflamed in a case which proved fatal in *two hours*. Blood of a dark colour may be effused in various parts within the folds, or beneath the lining membrane, — an appearance which has been mistaken for gangrene. [On this point see the case of the *Queen* against *Dore and Spry*, C.C.C. August 28, 1848; also Med. Gaz., Nov. 24, 1848.] The stomach often contains a mucous liquid of a dark colour tinged with blood. The coats are sometimes thickened in patches, being raised up into a sort of fungous-like tumour, with arsenic imbedded in them: at other times they have been found thinned. The mucous membrane is rarely found ulcerated, and still more rarely gangrenous. Ulceration of the mucous membrane, as the result of the action of arsenic, has been found as early as ten hours after the poison had been taken. Perforation of the coats is so uncommon a result of arsenical poisoning, that there are but few instances on record. In a case recently examined by M. Chevallier, the stomach of a person who had died from the effects of arsenic, was found perforated at the larger end. The aperture is described to have been of the size of a franc piece, round, soft, and somewhat thickened in its margin. There was no vascularity or sign of erosion about it, nor was there any appearance of ulceration on the other parts of the mucous membrane. Externally the stomach was covered with false membranes, arising from inflammation of the peritoneum. (Ann. d'Hyg. 1852, vol. 1. p. 448.) This case is so imperfectly reported that it is impossible to say whether the perforation was caused by arsenic, or whether it was the result of other morbid changes. The mucous glands of the stomach have been found enlarged; but this is by no means an unusual morbid appearance from any cause of local irritation, without reference to poisoning. Various morbid appearances are said to have been met with in the lungs, heart, brain and urinary organs: but they do not appear to be characteristic of arsenical poisoning. It is to the stomach and intestines that a medical jurist must look for the basis of medical evidence in regard to appearances after death

In a few instances the mouth, throat, and gullet have been found inflamed, but in general there are no changes in these parts to attract particular attention. The mucous membrane of the *small intestines* may be inflamed throughout, but commonly the inflammatory redness is confined to the upper part or to the duodenum, especially to that portion which joins the stomach. Of the large intestines the rectum appears to be the most prone to inflammation. The liver, spleen, and kidneys present no appearances which can be connected with the action of arsenic, although these, like the other soft organs, may become receptacles of the absorbed poison. It is worthy of observation in relation to the known antiseptic properties of arsenic, that the parts especially affected by the poison (the stomach and intestines) occasionally present the well-marked characters of irritant poisoning for a long time after death. In two cases (*Chesham*) referred to me by Mr. Lewis, coroner for Essex, a deep red inflammatory appearance of the mucous membrane immediately below a layer of sulphuret of arsenic was well marked, although the bodies had been buried *nineteen* months. In a case of exhumation which occurred in March, 1848, the stomach was well preserved and retained an inflammatory redness after the lapse of *twelve* months. Absorbed arsenic does not, however, appear to prevent the decomposition of the soft organs in which it is deposited. For a summary of the appearances caused by arsenic, and the influence of this poison in modifying putrefactive changes, I must refer the reader to a paper by Dr. Geoghegan (Medical Gazette, vol. 46. pages 171 and 218; and observations on Arsenical Poisoning, Dublin Quarterly Journal, Feb., 1851).

Quantity required to destroy life.—The smallest fatal dose hitherto recorded was observed in a case communicated by Dr. Castle, of Leeds, to the Provincial Journal (June 28, 1848, page 347). A woman took half an ounce of Fowler's solution (Arsenite of Potash) in unknown doses, during a period of five days. She then died: and on examination the stomach and intestines were found inflamed. Death took place by syncope (mortal fainting), and there was an absence of vomiting and purging. The quantity of arsenic which here destroyed life could not have been more than *two grains*. In another case, two grains and a half of arsenic, contained in two ounces of Fly-water, killed a robust healthy girl, aged nineteen, in thirty-six hours. (See Med. Gaz. vol. 39. p. 116.) Hence a medical witness will be justified in stating that under circumstances favourable to its operation, the fatal dose of this poison in an adult is from *two to three grains*.

Period at which death takes place.—Some remarks on the important bearing, which an answer to this question may have in a case of arsenical poisoning, have been elsewhere made (ante, p. 19.) From the numerous well-observed cases, which are now on record, it would appear that large doses of arsenic commonly prove fatal in from eighteen hours to three days. The average time at which death takes place is twenty-four hours; but the poison may destroy life within a much shorter period. There are now many authentic cases reported, in which death has occurred in from three to six hours. In 1845 I met with a well-marked case of death from arsenic in five hours, and in another, which occurred in April, 1849, death took place in two and a half hours. (Guy's Hospital Reports, Oct. 1850, 183. See also Ann. d'Hyg. 1837, vol. 1. p. 339.) It is singular that a few years since observations were so limited that it was thought to be impossible that arsenic could destroy life in a shorter period of time than seven hours (see p. 19, *Russell's case*); and this rapidity of death was actually considered as a medical fact, which in some measure tended to negative the allegation of death from arsenic! I am indebted to Mr. Foster, of Huntingdon, for a case which proved fatal with unusual rapidity. This gentleman satisfactorily ascertained that a child under three years of age, died within *two hours* from the effects of arsenic. The quantity taken could not be determined; but the time at which death takes place is by no means dependent on the quantity of poison taken. Dr. Borland, who formerly attended my lectures, communicated to me a case in which death probably occurred in less than two hours. The most rapidly fatal case which I have met with is that of a youth, æt. seventeen, who died in April, 1860, from the effects of a large dose of arsenic, the symptoms from which he suffered being of a tetanic character. The poisoning was the result of an accident at Ramsey, in the Isle of Man. The medical evidence at the inquest was to the effect that not more than *twenty minutes* had elapsed between the time at which deceased sat down to eat his supper, containing the poison, and his death. I am indebted to Mr. A. Thompson, of King's College, for a report of this case. In a case published by Dr. Dymock, a girl, aged twenty, took two ounces of powdered arsenic, and died in less than *two hours and a half*. The girl vomited violently and was sensible to the last. The mucous membrane of the stomach was covered with bright patches of a scarlet colour. (Ed. Med. and Surg. Journ., April, 1843.) In some instances death does not occur until long after the average period. In one case in which an adult swallowed about half an ounce, death did not take place for *fifty hours*, and it is remarkable that there was an entire absence of pain. (Med. Gaz. vol. 48. p. 446.) In the case of the *Duke de Praslin*, one large dose was taken, but death did not occur until the *sixth* day. (Ann d'Hyg. 1847, vol. 2. p. 367.) In October, 1847, a man who had swallowed 220 grains of arsenic was admitted into Guy's Hospital. He died on the *seventh* day. It is obvious that a patient who recovers from the first effects of this poison may still die from exhaustion or other secondary causes many days or weeks after having taken it. In *Reg. v. M'Cormick*, tried at the Liverpool Assizes, a child, after partially recovering from the first effects, died, as it appeared, from one dose of arsenic, after the lapse of twelve days. (Med.

Gaz. vol. 33. p. 434.) In the case of *Dr. Alexander* death took place on the *sixteenth* day. (Med. Times and Gazette, April 18, 1857, p. 389.)

In one instance in which arsenic was applied externally to the head, the person did not die until the *twentieth day.* The longest duration of a case of poisoning by arsenic which I have met with is reported by Belloc. A woman, aged fifty-six, employed a solution of arsenic in water to cure the itch, which had resisted the usual remedies. The skin became covered with an erysipelatous eruption, and the itch was cured, but she experienced severe suffering. Her health gradually failed, and she died after the lapse of *two years,* having suffered during the whole of this period from a general tremor of the limbs. (Cours. de Méd. Lég., 121.)

Chemical analysis.—Arsenic as a solid.—In the simple state, *white arsenic* may be identified by the following properties:—1. A small quantity of the powder, placed on platina foil, is entirely volatilized at a moderate heat (370°) in a white vapour. Should there be any residue, it is impurity; sometimes plaster of Paris or chalk is found mixed with it. If a small portion of the white powder be very slowly heated in a glass tube of narrow bore, it will be sublimed without melting, and form a ring of minute octahedral crystals, remarkable for their lustre and brilliancy. Under a microscope of high magnifying power, (250 diameters) the appearance of these crystals is remarkably beautiful and characteristic: one not exceeding the 4,000th of an inch in size may be easily recognized by the aid of this instrument. It will be observed in these experiments that white arsenic in vapour possesses no odour. 2. On boiling a small quantity of the powder in distilled water, it is not dissolved, but it partly floats in a sort of film, while a part becomes aggregated in small lumps at the bottom of the vessel. It requires long boiling, in order that it should become dissolved and equally diffused through water. 3. When the powder is treated with a solution of hydrosulphuret of ammonia in a watch-glass, there is no change of colour, as there is with most metallic poisons: on heating the mixture, the white powder is dissolved: and on continuing the heat until the ammonia is expelled, a rich yellow or orange-red film is left (sesqui-sulphuret of arsenic), which is soluble in all alkalies, and insoluble in hydrochloric acid.

Reduction-process.—When a small portion of the powder, *i.e.* from one-fourth to one-twentieth part of a grain, is heated with some reducing agent containing carbon (the best substance for this purpose is *soda-flux* obtained by incinerating acetate or tartrate of soda in a close vessel) in a glass tube about three inches long and one-eighth of an inch in diameter, it is decomposed: a ring of metallic arsenic of an iron-grey colour is sublimed and deposited in a cool part of the tube. At the same time there is a perceptible odour, resembling that of garlick, which is possessed by metallic arsenic only, while passing from a state of vapour to arsenious acid. This *odour* was at one time looked upon as peculiar to arsenic, but no reliance is now placed on it as a matter of medical evidence—it is a mere accessory result. In this experiment of reduction, there are commonly two rings deposited in the tube: — the upper ring has a brown colour, and appears to be a mixture of finely divided metallic arsenic and arsenious acid. In order to determine the *weight of the sublimate*, the glass tube should be filed off closely on each side of the metallic ring, and weighed; the sublimate may then be driven off by heat, and the piece of glass again weighed :—the difference or loss represents the weight of the sublimate. These sublimates are remarkably light, and require to be weighed in a delicate balance. By heating gently the piece of tube, with the sublimate reduced to powder, in another tube of larger diameter, the metallic arsenic, during volatilization, forms octahedral crystals of arsenious acid, which may be dissolved in a few drops of water, and tested by one or more of the liquid reagents. The metallic sublimate, or the crystals produced from it, may be subjected to the following process, in order to determine their real nature:—Break the glass on which the sublimate is deposited into fragments, and digest these in a few drops of the strongest nitric acid previously proved to be free from arsenic. The sublimate, if due to arsenic, is thereby converted to arsenic acid. The acid solution should be evaporated to dryness; the white uncrystalline residue dissolved in a few drops of distilled water, and a solution of nitrate, or ammonio-nitrate, of silver added. A brick-red precipitate indicates arsenic acid, and thus proves incontestably that the sublimate was of an arsenical nature.

The *process of reduction*, with these corroborative results, is, when thus applied, conclusive of the arsenical nature of the substance under examination. Any doubt respecting a sublimate may be removed by a careful microscopical examination. It is advisable, although not absolutely necessary, that we should apply the three foregoing tests to the white powder, before attempting to extract the metal from it.

Arsenic in solution in water: Liquid tests.—The solution is clear, colourless, possesses scarcely any perceptible taste, and has a slightly acid reaction. In this state, we should first evaporate slowly a few drops on a glass plate, when a confused crystalline crust will be obtained. On examining this crust with a common lens, it will be found to consist of numerous minute octahedral crystals, presenting triangular surfaces by reflected light. By this simple experiment arsenic is distinguished from every other metallic poison.

1. *Silver-test.*—On adding to the solution *Ammonio-nitrate of silver*, a rich yellow precipitate of arsenite of silver falls down;—rapidly changing, under exposure to daylight, to a greenish-brown colour. The test is made by adding to a strong solution of nitrate of silver, a weak solution of ammonia, continuing to add the latter, until the brown oxide of silver, at first thrown down, is almost re-dissolved. The yellow precipitate is soluble in nitric, tartaric, citric, and acetic acids, as well as in ammonia. It is not dissolved by potash or soda.

2. *Copper-test.*—On adding to the solution of arsenic *Ammonio-sulphate of copper*, a rich green precipitate is formed, the tint of which varies according to the proportion of arsenic present, and the quantity of the test added: hence, if the quantity of arsenic be small, no green precipitate at first appears; the liquid simply acquiring a blue colour from the test. In less than an hour, if arsenic be present, a bright green deposit is formed, which may be easily separated from the blue liquid by filtration. This test is made by adding ammonia to a weak solution of sulphate of copper, until the bluish-white precipitate, at first produced, is nearly re-dissolved: it should not be used in large quantity if concentrated, as the deep blue colour tends to obscure or conceal the green precipitate formed. The precipitated arsenite of copper is soluble in all acids, mineral and vegetable, and in ammonia, but not in potash or soda. If to the blue ammoniacal solution of this precipitate a crystal of nitrate of silver is added, a film of yellow arsenite of silver will appear around the crystal. (Chem. News, No. 1. p. 12.) If a strong solution of nitrate is added to the blue liquid, nearly neutralized by diluted sulphuric acid, a yellow precipitate of arsenite of silver is produced. Thus the silver and copper tests may be employed with one quantity of liquid. The *dried* precipitate of arsenite of copper, when slowly and moderately heated in a reduction-tube, yields a well-marked ring of octahedral crystals of arsenious acid, oxide of copper being left as a residue.

3. *Sulphuretted hydrogen test.*—The hydrosulphuret of ammonia gives no precipitate in a solution of arsenic until an acid has been added, whereby arsenic is known from most metallic poisons. On adding an acid (acetic or dilute hydrochloric free from arsenic), a rich golden yellow-coloured precipitate is thrown down (orpiment or sulphuret of arsenic). It is better, however, to employ in medico-legal analysis, a current of washed sulphuretted hydrogen gas, which is easily procured by adding to sulphuret of iron in a long-necked bottle a mixture of one part of strong sulphuric acid and three parts of water. The arsenical liquid should be slightly acidulated with pure diluted hydrochloric acid, *before* the gas is passed into it: at least, care should be taken that it is not alkaline. The yellow compound is immediately produced if arsenic be present, and it

may be collected after boiling the liquid sufficiently to drive off any surplus gas. The precipitation is likewise facilitated by adding to the liquid a solution of hydrochlorate of ammonia. This yellow precipitate is known to be sulphuret of *arsenic* by the following properties:—1. It is insoluble in water, alcohol, and ether, as well as in diluted hydrochloric acid, and vegetable acids: but it is decomposed by strong nitric and nitro-hydrochloric acids. 2. It is immediately dissolved by potash, soda, or ammonia; forming, if no organic matter be present, a colourless solution. 3. When dried and heated with three parts of soda-flux, or with a mixture of three parts of dry carbonate of soda and one part of dried cyanide of potassium, it furnishes a sublimate of metallic arsenic. This last experiment requires a little care, as some sulphur is apt to be sublimed, and obscure the results. If fine pulverulent silver be used as the reducing agent, and the heat *gently* applied, the arsenic may be evolved at once from the sulphuret, in a ring of octahedral crystals of arsenious acid. 4. The arsenical nature of the yellow precipitate may be also conclusively proved by heating it in the strongest nitric acid, and evaporating to dryness. A residue of arsenic acid is thus obtained, which, when dissolved in a few drops of distilled water, neutralized by ammonia, and tested by nitrate or ammonio-nitrate of silver, yields a brick-red precipitate of arsenite of silver. 5. In place of nitric acid, the sulphuret may be deflagrated in a porcelain capsule with a mixture of nitrate and carbonate of soda. When the melted mass is colourless, it may be heated with strong and pure sulphuric acid, so as to drive off the nitric acid, and the residue, dissolved in hot water, can now be submitted to Marsh's process. Unless two or more of these properties are proved to be possessed by the yellow precipitate formed by sulphuretted hydrogen in an unknown liquid, it cannot be a compound of arsenic; and it would not be safe as a general rule to receive evidence on the point. On the other hand, when these properties (especially 3 and 4) are possessed by the precipitate, it must be arsenic, and can be no other substance.

Marsh's process. Hydrogen test.—The action of this test depends on the decomposition of arsenious acid and its soluble compounds, by hydrogen evolved in the nascent state from the action of diluted sulphuric or hydrochloric acid on zinc. The apparatus is of the most simple kind, and is so well known as to need no description. The arsenic may be introduced into the short leg of the tube in the state of powder; but it is far better to dissolve it in water, by boiling, either with or without the addition of a few drops of potash. The metallic arsenic combines with the hydrogen, forming arsenuretted hydrogen gas, which possesses the following properties:—1. It burns with a bluish-white flame, and thick white smoke (arsenious acid). 2. A cold plate of glass or white porcelain held in the flame near the point, receives a dark stain from the deposit of arsenic upon it. This stain is composed in the centre of pure metallic arsenic, which (as it is formed on glass) may be sometimes raised in a distinctly bright leaf of metal,—immediately on the outside of this is an opaque black ring (suboxide of arsenic), which, when viewed by transmitted light, is of a clear hair-brown colour at the extreme edge. If the quantity of arsenic is small, the metallic lustre and opacity may be wanting, and the whole stain will have a brown colour by transmitted light. On the outside of this black ring, is a thin wide film of a milk-white appearance, which is nothing more than arsenious acid reproduced by combustion. 3. A white saucer or a slip of card or paper moistened with ammonio-nitrate of silver, held about an inch above the point of the flame, will be found, if arsenic is present, to be coloured yellow, from the reproduced arsenious acid being absorbed, and forming yellow arsenite of silver, easily soluble in acetic acid and ammonia. 4. Nitrate of silver on paper is immediately blackened and reduced by the unignited gas. The chemical reaction of this gas on nitrate of silver, by which the silver is reduced to the metallic state and the arsenic is simultaneously converted to arsenious acid, presents one of the most simple methods of testing the purity of the ingredients used in an analysis. Before testing the suspected solid or liquid for arsenic, a portion of the zinc and diluted acid used should be placed in a flask provided with a tube bent at two right angles, and the gas conducted into a small quantity of a moderately strong solution of nitrate of silver. If the materials are pure, the solution will not be darkened or blackened by the passage of the gas. If this blackening is observed sooner or later, it may depend on the presence of arsenic, sulphur, or phosphorus. In order to determine which of these three substances has produced the effect,—the gas is conducted for an equal time into a glass containing a small quantity of the strongest nitric acid saturated with nitrous acid. After some time, the nitric acid may be evaporated to dryness on a sand-bath, and the dry residue, if acid, neutralized by a few drops of solution of ammonia, and nitrate of silver then added. If arsenic was present in the gas, a brick-red precipitate of arseniate of silver will be immediately produced. An equal quantity of nitric acid should be first evaporated and the residue tested in a similar manner for arsenic acid. 5. Arsenuretted hydrogen is decomposed by a full red heat, and metallic arsenic is deposited in front of the point heated. A hard glass tube, drawn out to a capillary diameter in three separate points, is connected with the flask or tube in which the hydrogen is generated, and a strong red heat is applied to the conducting tube at or about half an inch distance from each contracted portion. Metallic arsenic of an iron-grey lustre is deposited in the contracted part of the tube, and as many metallic deposits may thus be obtained as there are contractions in the tube. The further end of the tube may terminate in an open capillary point or dip into nitric acid in the manner above described. If left open, the gas is easily tested for sulphur as it issues, by holding to the open end a slip of filtering paper moistened with a solution of acetate of lead,—or for arsenic by employing paper moistened with a solution of nitrate of silver. For the success of this experiment a wider piece of tube containing broken fragments of chloride of calcium should be interposed between the German glass tube and the apparatus in which the gas is generated. This prevents any moisture from being carried over. Sulphur may also be arrested by placing paper soaked in acetate of lead and dried in the drying tube.

The sublimates deposited by heat may be examined like those obtained by the reduction process. 1. If arsenical, the sublimate may be converted to octahedral crystals by heat; and 2. It may be converted to arsenic acid by nitric acid and the residue tested. (See page 84.)

Objections to Marsh's process.—Other substances will combine with hydrogen, and when the gas is burnt, a deposit will be formed on glass which may be mistaken for arsenic. The only objection of any practical force is that founded on the presence of *antimony*. There are these differences between the arsenical and antimonial deposits: from the combustion of the gas the deposit of antimony has rarely the bright metallic lustre which that of arsenic commonly presents; by transmitted light it is of a smoky black, while that of arsenic is of a hair-brown colour. Although the antimonial is very similar in colour to the arsenical flame, yet the third property is entirely wanting. If the ammonio-nitrate of silver be held over the antimonial flame, the silver is reduced: no yellow arsenite is formed, as in the case of arsenic. This last criterion distinguishes the arsenical flame from that produced by all other combustible gases. A few drops of sulphide of ammonium placed on the deposit and slowly evaporated will leave a yellow sulphide soluble in ammonia—if arsenic; but a reddish-coloured sulphide insoluble in ammonia,—if antimony. The *arsenical deposit* may be further distinguished by collecting it in a capsule, dissolving it in nitric acid, evaporating to dryness, and adding nitrate of silver. A brick-red precipitate is formed if the stain has been caused by arsenic. The *antimonial deposit* thus acted on by nitric acid leaves an insoluble oxide of antimony which is not changed in colour by nitrate of silver until a small quantity of ammonia is added, when a black compound of antimonide of silver is produced. For the application of this corroborative test, the gas from the apparatus may be at once passed into strong and pure nitric acid. (For further details on this mode of employing Marsh's process, I must refer the reader to the Guy's Hospital Reports for October, 1860.)

Arsenic is commonly contained as an *impurity* in zinc, in hydrochloric and sulphuric acid: hence the purity of the materials employed must be determined before any reliance can be placed on the results. It is said that zinc and the acids can be easily obtained free from arsenic. According to my experience there is nothing more difficult. When pronounced pure, it will generally be found that they have not been minutely tested.

Reinsch's process.—In the application of this process, the liquid suspected to contain arsenic, or the solid dissolved in distilled water, is boiled with about one-eighth part of *pure* hydrochloric acid (proved to be free from arsenic), and a small slip of bright copper foil, wire or gauze is then introduced. If arsenic is present, even in small quantity, the polished copper acquires either immediately or within a few minutes a dark iron-grey coating from the deposit of this metal. This is apt to scale off, if the arsenic is in large quantity, or if the liquid is very acid or long boiled. We remove the slip of copper, wash it in water, dry it, and gently heat it in a reduction-tube, when arsenious acid will be sublimed in minute octahedral crystals: if these should not be apparent from one piece of copper, several may be successively introduced. A large surface of copper foil or copper gauze may be in this way rapidly covered. In the use of this process, Dr. Geoghegan has found that while the whole of the arsenic present is deposited on copper, but little more than one-half can be reobtained by sublimation in the crystalline state. (Dublin Quarterly Journal, Feb., 1851.) Dr. Rainey states that 1-1000th of a grain of arsenious acid will give a full steel colour to one square inch of copper surface, and he properly advises the analyst not to waste the arsenic (when present in small quantity), by spreading it in a thin film over too large a surface of copper. (See Proceedings of Glasgow Phil. Soc., December, 1849.) Dr. Maclagan has made some practical remarks on this subject, for which I must refer the reader to the Edinburgh Journal of Medical Science for 1848–9. Reinsch's process succeeds perfectly with powdered arsenic, the arsenites, arsenic acid, the arseniates, and common orpiment; but, as it has been shown by Dr. Rainey, its operation is not so delicate or certain with arsenic acid and the arseniates as with the other compounds of arsenic. The boiling must be continued for a longer time. When the quantity of arsenic is small, the polished copper merely acquires a faint violet or bluish tint, and the deposit is materially affected by the quantity of water present, or, in other words, the degree of dilution. But one great advantage is, that we are not obliged to dilute the liquid in the experiment, and there is no material loss of arsenic, as in the hydrogen process:—the whole may be removed and collected by the introduction of successive portions of copper. This process is extremely delicate, the results are speedily obtained, and are highly satisfactory. Among the cautions to be observed are these: 1. not to employ too large a surface of copper in the first instance; and 2. not to remove the copper from the liquid too soon. When the arsenic is in minute quantity, and the liquid much diluted, the deposit does not take place sometimes for half an hour. If the copper be kept in for an hour or longer, it may acquire a dingy tarnish from the action of the acid only. This is known by its want of metallic lustre, and its being easily removed by friction, as well as by its yielding no crystalline sublimate when heated.

Objections to Reinsch's process.—Certain objections have been urged to this process. Thus arsenic may be present in the hydrochloric acid: this is at once answered by boiling the copper in a mixture of the hydrochloric acid and water before adding the suspected liquid. This should always be a preliminary experiment. In the case of *Mrs. Wooler* (Durham Winter Assizes, 1855), some doubt was thrown on the scientific evidence by reason of the use of arsenical hydrochloric acid. The discovery of the impurity was not made until after the analysis was completed. Another objection is, that other metals are liable to be deposited on copper under similar circumstances. This is the case with *Antimony*, whether in the state of chloride or of tartar-emetic; and it is not always possible to distinguish by the appearance the antimonial from the arsenical deposit. Should the quantity of antimony be small, the deposit is of a violet red tint: if large of an iron-grey colour, resembling arsenic. There is one answer to these objections, namely, that from the arsenical deposit, octahedral crystals of arsenious acid may be procured by *slowly* heating either the slip of copper, or the grey deposit scraped from it, in a reduction-tube. If this experiment be carefully performed, a ring of crystallized arsenious acid will be easily obtained; this may be examined by the microscope, and afterwards boiled in a few drops of water, and the solution tested with the ammonio-nitrate of silver and sulphuretted hydrogen. When the sublimates are too small for such a solution and subdivision, they may be converted to arsenic acid, by digestion in nitric acid, by the process already described (ante, page 84), and the residue tested for arsenic acid by nitrate of silver. Such a corroboration is necessary, because the crystalline form of arsenious acid is not always distinguishable by the eye; and the antimonial deposit gives a white amorphous sublimate, which, however, is quite insoluble in water. Care must be taken not to mistake minute spherules of water, mercury, or hydrochloric acid for detached crystals of arsenic; and here the microscope will be found of great service. The facility of applying Reinsch's process renders it necessary that an experimentalist should be guarded in his inferences. It is not merely by the production of a deposit on copper that he judges of the presence of arsenic; but by the conversion of this deposit to arsenious acid, demonstrable by its crystalline form and its chemical properties. If a deposit take place on copper, and arsenious acid cannot be obtained by heating it, then the evidence of its having been caused by arsenic is insufficient. Owing to the neglect of these corroborative results, antimony and other substances have been occasionally mistaken for arsenic.

In conducting the chemical analysis in the case of the *Queen against Smethurst* (C.C.C. August, 1859), Dr. Odling and I found that all the varieties of copper in common use for Reinsch's process contained arsenic in greater or less proportion, and that when any salt was present which, by reaction with diluted hydrochloric acid, liberated chlorine, the copper was dissolved and the arsenic was set free in the acid liquid; and this arsenic was deposited on a fresh and clean surface of copper. The only salt which I have found to present a difficulty in this respect, when the hydrochloric acid was used in a proper state of dilution, was an alkaline *chlorate* which may be occasionally present in the contents of a stomach. The nitrates and phosphates do not liberate chlorine with the diluted acid, and therefore do not affect the action of the tests.

In turning to Reinsch's original report of his discovery, it will be found, that while he enforces attention to the purity of the *acid* employed, he merely directs that the *copper* should, previously to use, be cleaned with nitric acid, washed in water, and rubbed dry with filtering-paper. These are all the precautions given by the discoverer in reference to the selection of the copper. In fact, upon his plan any copper might be used, provided it had a clean surface. The test which he employed to determine the purity of his materials was that which has been in use among toxicologists up to the present day, namely, before introducing the suspected substance, to boil a piece of clean copper with the diluted hydrochloric acid for four or five minutes; and if it did not acquire any tarnish or deposit, the copper and acid were to be regarded as sufficiently pure for the detection of the poison. Undoubtedly a negative result under these circumstances would be a proof either of the entire absence of arsenic from the metal itself, or, if present, that it was so intimately combined with the substance of the copper (as arsenide) as not practically to affect the application of the process in a medico-legal analysis. Resting upon this simple fact, Reinsch says of his method, "Elle ne peut donner lieu a aucune méprise." Dr. Christison, who has employed it during a period of fifteen years for detecting arsenic in the tissues, says in his last edition on Poisons, that "copper-leaf or copper-plate, worn thin by the action of diluted acid or fine copper gauze, is the best form for use. . . . In all medico-legal inquiries it is necessary to perform a preliminary experiment with distilled water and the hydrochloric acid used, lest the acid contain arsenic. . . . It (the process) is not subject to any fallacy." If any additional authority is required to show how little toxicologists of great repute and enlarged experience suspected that arsenic was lurking in the copper which they were so frequently using, or that there was any better method of testing the purity of the materials than that originally devised by Reinsch, it is furnished to us in the extensive experience of Mr. Herapath, of Bristol. (Ure's Dictionary of Arts, &c., 2nd ed., Nov. 1859, p. 191. Also Guy's Hospital Reports for October 1860, p. 220.) This gentleman has been for many years in the habit of using and recommending the use of a coarse copper wire (No. 13) which contains arsenic in well-marked quantity; but he has never even had occasion to suspect the existence of arsenic in it. In fact, as he gives no directions for testing copper for arsenic before using it in Reinsch's process, while he scrupulously refers to the necessity of testing the zinc and acids employed, it is clear that he did not know that arsenic was there, or believed its presence to be of no importance to the result. The same may be said of the copper used by every chemist and toxicologist.

In fact, whether among English or French and German writers on chemistry and toxicology, there is not one who has ever pointed out, or even suspected, that Reinsch's process would lead to error by reason of the universal presence of arsenic in copper, commercial or refined, which is accessible to the chemist. All have hitherto relied upon the cleanness of the surface of the copper used, and the method of testing the acid and metal first pointed out by Reinsch in 1841. As a general rule, this is quite sufficient. There is no liability to fallacy unless the copper is used on a large scale, and there is an acid or salt present which acts upon and dissolves the impure metal. It is clear that if the presence of a minute quantity of arsenic in copper presents that great risk of fallacy, which some chemists have recently endeavoured to impress on the public mind, no one of the numerous analyses for arsenic by Reinsch's process, which have been undertaken during the last twenty years, could have been made without the inevitable discovery of arsenic. In short, if a source of fallacy, it would have led to the constant discovery of arsenic in every solid and liquid submitted to examination. Analysts who have had much experience in the use of this process are aware, that in employing samples of the same copper and acid,—for one affirmative result in which arsenic is discovered, there will probably be four or five negative results, in which no deposit whatever has taken place on the arsenical copper, and no arsenic was detected. By boiling successive quantities of the same arsenicated copper in the same acid liquid containing arsenic, the whole of the free arsenic is finally removed; the deposits on the metal become less and less decided, they at length cease altogether, and the last portion of copper put into the liquid comes out nearly as bright as when introduced, or if at all dull on the surface, this dulness arises, not from arsenic, but from oxidation, as a result of long boiling. It is obvious, that if the arsenic came from the copper itself, and not from any extraneous source, instead of the arsenic diminishing on each introduction of the copper, it would go on increasing in proportion to the quantity of the metal employed in the analysis. The hundreds of negative results which have been obtained by experienced analysts, establish the untruthfulness of the assertion, that the process, as it is commonly employed, is attended with a serious risk of fallacy, even when copper containing arsenic is unknowingly used. In fact, so long as the copper employed is not destroyed, and the acid is used so diluted as not to render the copper soluble, it is impossible that any arsenic can be set free from it. There is, however, great danger in endeavouring to conceal or distort a scientific truth, especially when, as experience now shows, reliance is placed upon false criteria to determine the presence or absence of arsenic in any given sample of copper.

Chemists have stated that arsenic rendered copper brittle, and that arsenicated copper could not be drawn into fine wire. Numerous facts, elsewhere related, show that this statement is incorrect. (Guy's Hospital Reports, Oct. 1860, loc. cit.) Copper may contain enough arsenic to deceive an analyst, and yet retain its usual ductility and flexibility. On the other hand copper entirely free from arsenic may be so brittle as to lose in great part its malleability and ductility. Another erroneous statement has found currency—namely, that copper deposited by electrolysis is necessarily free from arsenic. The experiments of Mr. Campbell and myself show that such copper frequently contains arsenic, and that although generally purer than ordinary refined copper, the electrotype metal requires testing before use, as much as any other sample. (Guy's Hosp. Reports, Oct. 1860, p. 231.)

The best method of testing copper for arsenic is, I believe, the following:—Expose the copper to air in a saucer or vessel containing pure and strong hydrochloric acid. In a few days a dark brown liquid is procured (a mixture of subchloride of copper in the surplus acid.) This acid liquid should be slowly distilled in a flask or retort by the aid of a sand-bath. If arsenic was contained in the copper, it is obtained as a clear, colourless chloride in the receiver with hydrochloric acid. The acid distillate, properly diluted, should now be placed with pure zinc in a flask, and the gas produced should be tested for arsenic by the various methods already described. (See page 86.)

It is unnecessary in this place to enter into a comparison of the processes of Marsh and Reinsch, in respect to their relative powers of enabling the analyst to detect small quantities of arsenic. It may be conceded that Marsh's process will detect a smaller quantity of arsenic than the process of Reinsch, but the latter, when the quantity of liquid is small, will detect the 1-150th or the 1-200th part of a grain of the poison, and this is itself a point of delicacy in analysis, which, when the issues of life and death are involved, might almost suffice to justify a reasonable distrust of the resources of science. It would require considerable courage to go beyond this, and it appears to me that in a criminal case it would not be safe to depose to the presence of arsenic from Marsh's process alone, when the quantity of poison was *too small* to admit of separation or corroboration by the process of Reinsch. Conversely, the results of Reinsch's should be corroborated by those of Marsh's process. When the point of detection by Reinsch's process has been passed, then we increase the chance of fallacy to which Marsh's process is always exposed, by the fact that such very minute traces of arsenic may have existed in some of the materials used, or in the apparatus employed. It was this over-reliance on the extreme delicacy of the process in researches where it admitted of no corroboration whatever, that led Orfila to assert that arsenic was a natural constituent of the human body!

CHAPTER II.

DETECTION OF ARSENIC IN ORGANIC LIQUIDS — IN THE TISSUES —ARSENITES— ARSENITE OF COPPER OR SCHEELE'S GREEN —ARSENIC ACID AND THE ARSENIATES—SULPHURETS OF ARSENIC—CHLORIDE OF ARSENIC.

Arsenic in liquids containing organic matter.—Arsenious acid, when in a state of solution, is not liable to be precipitated by any animal or vegetable principles, although such substances render it less soluble in water. It has been stated that arsenic enters into combination with albumen, but this is a point of no practical importance in reference to the present subject of inquiry. The liquid for analysis should be filtered through muslin, cotton (free from any arsenical dressing), or paper, in order to separate any insoluble matters: these should be well pressed and drained. Should the liquid be coloured, this is of little moment, provided it be clear. If viscid, it should be diluted with water, and boiled with a small quantity of hydrochloric acid; on standing, a deposit may take place, and this should be separated by a filter. As a trial test, we may now boil in a portion of the liquid, acidulated with pure hydrochloric acid, a slip of pure copper highly polished. In a few seconds, if arsenic is present, the copper will acquire a violet blue or grey metallic coating. If, after half an hour, the copper remains unchanged, arsenic is either absent or present in too small a proportion to admit of this mode of separation; if, on the other hand, the copper is covered with a grey deposit, it should be dried and heated in a reduction-tube in the manner already described (ante, page 89). This may be regarded as a trial test to determine whether arsenic is dissolved in the liquid or not.

Precipitation as sulphuret.—When arsenic is present in large quantity, in an organic liquid, it may be precipitated as sulphuret by a current of sulphuretted hydrogen. The liquid should be boiled, filtered, and acidulated with hydrochloric acid before passing the gas into it. When precipitation has ceased, the liquid should be again filtered, the precipitate collected, dissolved in ammonia, and reprecipitated by an acid. By digesting it in water, alcohol, and diluted hydrochloric acid successively, it may be deprived of any organic matter combined with it, sufficiently to allow of its reduction by soda-flux, cyanide of potassium, or metallic silver, in the manner described (p. 86). In this way it is easy to analyze wine, coffee, tea, milk, porter, brandy, and similar liquids for arsenic when present in large proportion. The yellow precipitate must, in all cases, be submitted to the corroborative tests.

The large quantity of organic matter with which the arsenic is mixed may interfere with its precipitation by sulphuretted hydrogen gas. In this case the organic matter may be most conveniently destroyed without loss of arsenic, by resorting to the process of Fresenius and Babo. The liquid previously concentrated may be mixed with its weight, or rather more than its weight, of strong and pure hydrochloric acid, water being added to make the mass fluid. The vessel containing the liquid is heated in a water bath, and finely-powdered chlorate of potash is then added to it in small quantities. Chlorine is set free, and the organic matter is destroyed. The chlorate should be added until the liquid is colourless, or nearly so, and of uniform consistency. It is then filtered and boiled until no more chlorine is evolved. Any arsenic present is converted to arseniate of potash. Sulphurous acid is now passed into the liquid, or bisulphite of soda is dissolved in it in small portions at a time, until it smells of sulphurous acid. It is again boiled to get rid of the surplus quantity of this gas. Hydrochloric acid is then added, in order to acidulate it, and the arsenic is precipitated as sulphuret by a current of sulphuretted hydrogen gas. The precipitated sulphuret may then be tested by the various methods already pointed out (p. 86). When the quantity of organic matter is large, and the proportion of arsenic small, this process has the disadvantage of charging the suspected liquid with a large quantity of saline matter, and at the same time a variety of chemical agents are employed, to the use of which an objection may be taken. In other cases arsenic may be present, but in too small a quantity to be precipitated by sulphuretted hydrogen. On these grounds another process is desirable.

Detection of absorbed arsenic.—In most cases of acute poisoning, in which the person dies within the ordinary period, arsenic may be found, but in variable quantity, in the muscles and soft organs of the body, as well as in the blood, bile, and urine. It may be detected in the liver, but in no other parts; and there are well authenticated cases in which, in spite of its having been taken and caused death, it has not been discovered in any of the structures of the body. The process by which its presence may be revealed depends on the ready conversion of arsenic to a volatile liquid chloride of arsenic—the production from one portion of the chloride of arsenuretted hydrogen, with its well-known properties (p. 87)—and from another portion the deposition of arsenic on pure copper by Reinsch's process.

Distillation process. 1. *Conversion to Chloride.*—If the substance to be examined for arsenic is *solid*, it should be reduced to a fine powder, or cut into small pieces. In the analysis of the liver, spleen, or other soft organs, it will be proper to cut these into small portions, and to dry them either by a current of air or by the aid of a water-bath, so as to deprive them as much as possible of water. If we have to deal with liquids such as the blood, bile, and urine, these may be brought to dryness in a water-bath. The complete separation of the arsenic depends greatly on the perfect desiccation of the substance and the concentration of the acid employed.

The dry residue is then covered with concentrated hydrochloric acid, the purity of which has previously been tested by operating on an equal quantity, according to the method already described (p. 87). The quantity of pure hydrochloric acid used must depend on the quantity of dry material for analysis. It should be sufficient to break up, dissolve, or mix freely with the whole of the solid residue. The mixture should be made in a retort or small flask fitted with a long condensing-tube, and then gradually heated by a sand-bath, until the acid liquid begins to pass over. The retort or flask may be connected with a receiver closely fitting to it, and holding a small quantity of distilled water. The water in the receiver should be just sufficient to condense and fix the acid vapours. The receiver, as well as the condensing-tube, should be kept cool by wetting its surface with cold water or otherwise. The perfect condensation of the distilled liquid is ensured by this arrangement. The distillation may be carried to dryness on a sand-bath, or nearly so; and it may be sometimes advisable, in order to ensure the separation of the whole of the arsenic as chloride, to add to the residue in the retort another portion of pure and concentrated hydrochloric acid, and again distil to dryness. I have, however, found that portions of dried liver and stomach gave up every trace of arsenic by one distillation, when a sufficient quantity of hydrochloric acid has been used in the first instance, and the distillation had been slowly conducted by a regulated sand-bath heat.

2. *Conversion of Chloride to Hydride.*—The liquid in the receiver is either a solution of chloride of arsenic in water, or a mixture of hydrochloric and arsenious acids. It is in general colourless, when care has been taken; or, if slightly coloured yellow, this will not interfere with the subsequent steps of the analysis. It contains no amount of organic matter which can lead to frothing in Marsh's tube, or to any deceptive results from the combustion of the gas produced. There is no loss by volatility at ordinary temperatures, since the water retains the chloride of arsenic; but at the same time it is proper either to proceed immediately with the examination of it, or to place it in a stoppered bottle to prevent loss by evaporation of the distillate. The arsenical liquid in this state may be preserved for examination at any future period.

One third of the distilled liquid may be diluted with four or five parts of water and boiled in a clean flask. When boiling, a piece of bright copper foil (free from arsenic), of about the size of the sixteenth of a square inch, should be introduced. If there is chloride of arsenic in the liquid, even up to the 1-4000th of a grain, its presence will be indicated by a change of colour, and by the deposit of a dark metallic film on the copper. If the liquid should be too much diluted for this purpose, it may be concentrated on the polished copper, and the deposit will after a time be apparent. If the quantity of arsenic present is believed to be very small, the surface of copper introduced should be proportionably small.

The remaining two thirds of the distilled liquid, sufficiently diluted, should now be introduced into a Marsh's tube, or an evolution flask provided with a funnel tube, the capacity of which must be regulated by the quantity of acid liquid to be examined. Pure zinc is then added, and the remaining steps of the process are precisely similar to those described under Marsh's process (ante, p. 87).

When the results obtained by Marsh's and Reinsch's processes are concurrent, it is conclusively proved that arsenic must have been present in the substance analyzed. We have here, in the production of metallic arsenic and of arsenic acid, as well as in the conversion of this compound to arseniate of silver, all the evidence which an analyst can desire. Beyond this it appears superfluous to carry the chemical proof. The combustion of the gas, as suggested by Marsh, with the collection of deposits from the flame, while it necessarily entails much loss, is not required in any stage. The decomposition of the hydride by a red heat in a close tube answers all the purposes of combustion, without the risk of loss from the frequent opening of a stop-cock. A larger quantity of metallic arsenic can be thus obtained in one operation; and any gas which escapes decomposition by heat may be arrested and decomposed by the nitrate of silver or nitric acid.

The zinc which has been used in one experiment is not fitted for use a second time. Some arsenic is always deposited upon it, which is evolved when hydrogen is again generated. I have substituted aluminum with hydrochloric acid as well as with potash, but I have not found this new metal to present any advantages over zinc. It contains no arsenic, but much iron and carbon.

Objections.—This process appears to be singularly free from the objections to which those of Marsh and Reinsch are exposed. In the first stage, if properly conducted, arsenic is separated from all metals excepting antimony and bismuth, and from all metalloids excepting sulphur, phosphorus, and that rare substance, selenium. Of all the metals known, fourteen produce volatile chlorides; but, with the exception of arsenic, antimony, and bismuth, these are deposited on cooling, in a solid condition. Most of these are chlorides of the rarer metals, which are not likely to be met with in any analysis of a medico-legal nature. The chloride of arsenic is volatile, and is easily distilled with aqueous vapour: the chlorides of antimony and bismuth require a much higher temperature for volatilization: and unless the material is distilled to dryness and subsequently heated, they are not likely to be found in the acid distillate. In the second stage, antimony comes over with hydrogen, like arsenic. The only other metals which combine with hydrogen to form a gas are potassium, tellurium, and zinc: and among the metalloids, sulphur, selenium, phosphorus, and carbon. When heat is applied to the current of gas, the only substance deposited in a form to be mistaken for arsenic is *antimony.* (For the distinctions between these metals see page 88.) The other substances present no difficulty whatever.

Arsenic acid and the alkaline arseniates, as well as the sulphide of arsenic, are not easily obtained in the form of chloride of arsenic by the distillation process. Some portion passes over as chloride of arsenic, but much remains unchanged in the retort. Arsenious acid and the arsenites, soluble and insoluble in water, are most readily obtained in the form of chloride. These compounds chiefly concern the medical jurist. To one case of poisoning by arsenic acid or the sulphide, there will be at least one hundred cases of poisoning by arsenious acid. Should it be required to distil arsenic acid or its compounds, it will be advisable to convert it to arsenious acid by a current of sulphurous acid, or by the addition of bisulphite of soda. Sulphide of arsenic may be similarly transformed, by being first treated with nitric acid or nitrate of potash. (See p. 86.)

This process may be safely adopted without interfering with the research for other poisons. With the exception of mere traces of antimony and bismuth that pass by distillation, all other metals remain in the residue after distillation; and with respect to these two metals, the greater proportion remains behind. Hence after separating arsenic, the residue may be examined for antimony, mercury, copper, lead, and other metallic poisons, by the ordinary processes. On the other hand, if the presence of any volatile poison, such as alcohol, prussic acid, ether, or chloroform, is suspected, a water-bath distillation, to separate any of these liquids, may be resorted to, before commencing the research for arsenic. A portion of the residue may in all cases be reserved for the research for organic alkaloids.

The subjoined experiments were made in order to test the efficacy of the process. *The stomach.*—The contents and part of the coats of the stomach of a person had been examined for arsenic by Reinsch's process, and no arsenic was found. The remainder of the stomach had been exposed for some months, and was in a dry state. A solution containing three eighths of a grain of arsenic was poured over the surface; in this state it remained exposed five months longer. One third of it was then cut up and distilled with two ounces of pure hydrochloric acid, in the manner already described (p. 96). The distillate was acid, and nearly colourless. It yielded arsenic readily by Reinsch's process, as well as metallic arsenic from arseniuretted hydrogen,—arsenious acid by the use of nitrate of silver, and arsenic acid by the use of nitric acid. The dry residue in the retort was tested by Reinsch's process: it contained no arsenic. In this experiment, the quantity of arsenic operated on in the substance of the stomach could not have exceeded one eighth part of a grain. *The liver.*—Sixty grains of the dried liver of a person who died about five years since from the effects of arsenic, were broken up and distilled with hydrochloric acid. A slightly coloured, offensive liquid was obtained in the receiver, which yielded arsenic readily by the methods described, in all the forms in which arsenic admits of recognition. The residue in the retort contained no arsenic.

It was found equally effectual in the separation of arsenic from the sediment of river-water; from arsenical paper-hangings, and a variety of substances containing arsenic. (See Guy's Hospital Reports, Oct. 1860, p. 253.)

Quantitative analysis.—The quantity of arsenic met with in a free state in the stomach and bowels after death, is subject to great variation. The quantity found has varied from half a grain to two ounces, or 960 grains. The circumstances which affect this quantity have been elsewhere considered (pp. 23, 104). Whether we are dealing with a liquid article of food or with the contents of a stomach, assuming that the arsenic is dissolved, we pursue the same plan. In some cases solid arsenic, in lumps or powder, may be separated by washing from the contents. In this case we simply collect it, dry it, and weigh it. When the arsenic is dissolved, a measured portion (one fourth or one sixth) of the liquid should be acidulated with diluted muriatic acid, boiled and filtered. A current of sulphuretted hydrogen may now be passed into it, until there is no longer any precipitation. The liquid should be again boiled, and the precipitated sulphuret of arsenic collected either by decantation or on a filter and thoroughly washed. While still moist, it may be dissolved in ammonia, and the ammoniacal liquid filtered into a balanced capsule, from which the ammonia may be driven off by evaporation. The sulphuret of arsenic dried at 212° may now be weighed, and as every *hundred* grains of sulphuret represent *eighty* grains of white arsenic (100 : 80·4), the quantity of the latter may be found sufficiently close for practical purposes in multiplying the weight of the precipitate by 4 and dividing the product by 5. When we are dealing with the *tissues*, the quantity of arsenic is generally too small for the application of this method. In all cases the *deposited* arsenic is in very small proportion, rarely exceeding a few grains in an organ like the liver weighing four or five pounds; and according to Flandin, although his statement is not in accordance with the experience of others, *nine tenths* of the deposited arsenic are found in the liver, the other tenth being unequally diffused through the other organs. (Op. cit. vol. 1. p. 564.) If the quantity of arsenic present is moderately large, it may be determined in the first stage, viz. by adding to the distillate containing chloride of arsenic a sufficient quantity of a solution of chloride of gold, and boiling the mixture. After some time the gold is entirely reduced and precipitated. Its weight will enable the operator to calculate the proportion of arsenic present. If there is a ponderable quantity of arsenic present, the distillate, or an aliquot part of it, should be diluted, placed, with metallic zinc, in the apparatus described, and the gas produced entirely transmitted into strong nitrico-nitrous acid. When all the arsenic has come over, the acid should be evaporated in a light balanced capsule on a sand-bath, and the weight of arsenic may be known approximately by the weight of the residue. If converted to arseniate of silver, and the quantity is sufficient for collection on a filter, this precipitate may be dried and weighed. Every 100 parts of the arseniate of silver are equivalent to 21·38 parts of arsenious acid. In reference to imponderable quantities, the only method of estimating the quantity of arsenic is by comparing the amount of metallic deposit obtained as a result of heating the current of arseniuretted hydrogen, with the amount obtained from a weighed quantity of arsenic, dissolved in water, and treated in a similar manner. For determining the quantity in the *tissues*, a known weight,—one hundred grains of dry liver, may be distilled: — the chloride obtained converted entirely to hydride, and this, decomposed by passing the gas into nitric acid until the arsenic is exhausted. The residue left by evaporation will be arsenic acid, of which 100 parts correspond to 65·2 of arsenious acid.

The *contents of the stomach* are often mixed with lumps of arsenic, which may be separated by throwing those portions that do not pass through a filter into a large glass of distilled water, and after giving to it a circular motion, suddenly pouring off the supernatant liquid, when the heavy portions containing solid arsenic will be found at the bottom. The lumps left in the contents may be easily removed, dried on filtering paper, and tested. If the arsenic has been taken in fine powder, there will be no lumps, but it will probably be deposited in masses, mixed with mucus and blood, on the coats of the organ, chiefly in those parts where it is much inflamed and ulcerated. The arsenic in this state looks like moistened plaster of Paris, but it is of a darker colour, and when examined by a lens it is crystalline. It may be removed on as patula, spread in masses on filtering paper, and slowly dried. As it dries the granules will detach themselves from the mass, and they may then be easily tested either by the Reduction or by Reinsch's process; *i. e.* by boiling the suspected particles, or even the stained portions of paper on which the organic matter has become dried, with hydrochloric acid and pure copper. Mucus, blood, or even a layer of the mucous membrane of the stomach, may be thus readily tested.

When arsenic is discovered in the stomach mixed with food, it does not necessarily follow that it has been administered in that particular article of food. Should the person have partaken of food such as milk or gruel, subsequently to the swallowing of arsenic, these fluids will necessarily acquire an arsenical impregnation from the poison already contained in the stomach. The patients may have taken the arsenic in one kind of food, when another and an innocent description of food might thus inadvertently be pronounced to have been the vehicle. (See on this point the case of *Ann Merritt*, London Med. Gaz., Aug. 16, 1850, vol. 46. p. 291.)

If the patient has died with arsenic in the body, there is scarcely any limit to the period at which it may be detected. In the cases of two children examined by Mr. Herapath, in July, 1849, the poison was discovered in the remains of the dead bodies after eight years' interment; in another case by Dr. Glover after twelve years (Lancet, July 9, 1853, p. 41); and in a remarkable instance which occurred to Dr. Webster, of Boston, it was discovered in the remains of a body, after fourteen years' burial in a tomb. It has been sought for, and not found, at much shorter periods after death when there was a very strong suspicion that the poison had been taken: but it is highly probable that in these cases there was little or no arsenic in the bodies at the time of interment. The longer a person has survived after taking the poison, the less probable is it, *cæteris paribus*, that arsenic will be found in the remains. With respect to its detection in the stomach and bowels, if the vomiting and purging have been violent and the person has survived some days, none may be found. It is singular, however, to notice with what tenacity the mineral occasionally adheres to the mucous membrane in spite of vomiting and purging. In the case of the *Duke of Praslin*, who died in six days from a large dose of arsenic, some portion was still found in the intestines (Ann. d'Hygiène, 1847, p. 402); and in a more recent case which was the subject of a criminal trial at the Leicester Autumn Assizes in 1860 (*Regina* v. *Holmes*), Mr. Lankester informed me that arsenic was detected in the intestines although the deceased had survived the effects of a large dose for seven days, and had suffered from the usual symptoms.

In those cases in which arsenic is found in a solid state after long interment, it is generally under the form of sulphuret or yellow arsenic, the white arsenic being thus partially changed in composition and colour during the process of putrefaction. This change of colour, however, is not always met with, even in bodies which have been buried for a year, or longer. (See Guy's Hosp. Reports, Oct. 1850, p. 206.) Care must be taken not to confound stains produced by bile on the stomach or intestines after long periods of interment, with those caused by sulphuret of arsenic.

The medical practitioner should be aware that a crystalline substance resembling arsenic is very often produced in the dead stomach at variable periods after interment. These crystals consist of ammonio-phosphate of magnesia derived from putrefaction. I have met with them in several case of exhumation. They have been mistaken for arsenic, and their occurrence has in some instances led to unjust suspicions and accusations. (See Guy's Hosp. Reports, Oct. 1850, p. 222.) An analysis will of course remove any doubt. For many important facts connected with the quantity of absorbed arsenic deposited in the tissues, the time at which it is deposited, as well as the relative proportions found in different organs, and in the same organ at different periods after the taking of the poison, I must refer the reader to a paper by Dr. Geoghegan. (Dublin Quarterly Journal, Feb. 1851.) According to observations made by this gentleman, the largest quantity of arsenic was found in the liver, in about fifteen hours after the poison had been taken. It amounted to two grains for the whole organ. The earliest period at which he met with it was seven hours,—the quantity being 0·8 grs., and the latest fourteen days, the quantity in the whole organ being 0·17 grains.

It is important, in reference to the *tissues*, to observe that arsenic may be found in them even at an early period, when it is either absent or only doubtfully present in other parts. In a case referred to me by Mr. Gell, coroner for Sussex, in May, 1854, the deceased, *Burton*, died within *four hours* after he had been attacked with symptoms of poisoning by arsenic. Arsenic was found in small quantity in the stomach, duodenum, and rectum. It was also detected in the liver and spleen; and the proportion found was greater in the latter than in the former organ. The precise time at which the poison was taken could not be determined; but the fact mentioned shows that its deposition in the tissues takes place very rapidly. In the cases of the *Atlee* family, referred to me by Mr. Carter, coroner for Surrey, in January, 1854, the body of the mother was exhumed after a month. Arsenic was *not* found in the *stomach* or *bowels*, but it was readily detected in a small portion of the *liver*. The poison had probably been taken several days before death. This fact is of considerable importance in relation to a medical opinion of the presence or absence of poison in a dead body. It is commonly the practice to confine an analysis to the stomach and bowels only; and when no poison is found therein, to report that no poison exists in the body, and to refer death to natural causes. It is clear, however, from the above case, that such an opinion might be erroneous unless the liver or spleen had undergone a chemical examination. In reserving viscera for analysis, a portion of the liver should therefore always be examined.

If the person has lived fifteen or sixteen days after having taken the poison, no trace may be found in the tissues or in any part of the body. Orfila long since expressed this opinion from his experiments on animals; its correctness has been strikingly confirmed by the case of *Dr. Alexander*, who died in sixteen days from a large dose of arsenic taken by mistake in arrow-root. Dr. Geoghegan, who was deputed to make an analysis of the stomach and other viscera, found no trace of the poison, either absorbed or unabsorbed, in any part of the body which he examined. (See Med. Times and Gazette, April 18, 1857, p. 389.)

In the case of *Soufflard*, a large dose of arsenic had been taken; but according to M. Legroux, no trace of the poison was found in the stomach or in the ulcerated portions of the bowels. (Univ. Medicale, June 30, 1850.)

It need hardly be observed that the *quantity of arsenic found in the stomach* or other organs can convey no accurate idea of the quantity actually taken by the deceased; since more or less of the poison may have been removed by violent vomiting and purging as well as by absorption and elimination. A large quantity found in the stomach or bowels indicates a large dose; but the finding of a small quantity does not prove that the dose was small. Notwithstanding these very obvious causes for the removal of a poison from the body, there is a strong prejudice among lawyers that the chemical evidence is defective unless the quantity found is sufficient to cause death. It would be just as reasonable, in a case in which a man has been killed by a discharge of small shot, to insist upon a failure of proof of the cause of death, because only a single pellet has been found on the body. The value of chemical evidence does not depend on the discovery of any particular *quantity* of poison in the stomach,—it is merely necessary that the evidence of its presence should be clear, distinct, conclusive, and satisfactory. At the same time, a reasonable objection may be taken to a dogmatic reliance upon the alleged discovery in a dead body of minute fractional portions of a grain; and considering the great liability to fallacy from the accidental presence of arsenic in the articles used, the chemical evidence in the case of *Laffarge*, in which the whole quantity discovered in the body was stated to be the hundred and thirtieth part of a grain, was of a most unsatisfactory kind, and should have been rejected by the Court. No man with any respect for his character, or for the common sense of a jury, would base chemical evidence on the thousandth, or less than the thousandth, part of a grain of poison in a case of life and death: although he may make use of his alleged power to detect this, or even a smaller quantity, for the purpose of procuring the acquittal of a notorious criminal.

It has been supposed that the *quantity* of arsenic found in the stomach and bowels might throw a light on the question, whether the poison had been taken voluntarily with the intention of committing suicide, or whether it had been criminally administered by another. There is no doubt that a much larger dose may be taken by a suicide than could be secretly administered by a murderer; and thus, if a large quantity be found in the stomach, it is supposed to furnish a presumption in favour of suicide and against murder. Suicides have been known to take as much as two tablespoonfuls, or *one thousand grains*, of arsenic.

How much may remain in a dead body must, however, depend on the amount of vomiting and purging, and the length of time the person survives. In one case of murder by poison I found in the stomach, on the exhumation of a body, eighteen months after death, twenty grains of arsenic. In the case of *L'Angelier* (*Reg.* v. *Madeleine Smith*, Ed. High Court of Justiciary, June and July, 1857), Dr. Penny stated in evidence that the quantity of arsenic which he found in the stomach and contents of deceased amounted to *eighty-eight grains*, and that some part of this was in hard, gritty, colourless, crystalline particles. As there was arsenic in the contents of the intestines, and there had been vomiting and purging, it is obvious that the deceased must have taken a very large dose of the poison; and it was one of the suggested difficulties of the case to determine how the deceased could have taken the poison in so large a quantity unknowingly. The quantity found, however, amounted to no more than half a teaspoonful; and admitting that one half of the dose taken had been ejected, the question resolves itself into this: whether a teaspoonful of arsenic might not have been homicidally administered in chocolate, gruel, or some viscid liquid, or in a state of admixture with solid food. Although it is unusual to find half a teaspoonful of arsenic remaining in the stomach in a case of homicidal administration, it appears to me impossible to admit that this fact is inconsistent with an act of murder. A man half intoxicated might be thus poisoned; and if death took place in a few hours, even a larger quantity than that which was here found might remain in the stomach. Dr. Christison has now set this question at rest by the publication of a case in which a man was homicidally destroyed by arsenic, and the quantity found in the stomach after death was from ninety to one hundred grains. The man had survived from five to seven hours, and there had been frequent vomiting of a yellowish or greenish coloured liquid during this period. The arsenic was administered in whiskey-punch with sugar, and it was kept in suspension by constant stirring. (Ed. Monthly Med. Journal, December, 1857, p. 481.) In *Regina* v. *Dodds*, tried at the Lincoln Assizes in December, 1860, the prisoner was charged with administering arsenic to deceased with intent to murder. The quantity stated to have been found in the stomach by the medical witnesses was one hundred and fifty grains. There was not the least reason to suppose that the deceased had voluntarily swallowed this quantity.

The condition of the arsenic found in a dead stomach should be specially noticed. A witness should be prepared to say whether it is in fine powder or coarse fragments; whether it is mixed with soot or indigo, or whether it is in the ordinary state of white arsenic. These points may be material as evidence.

Arsenic is *not* a normal constituent of the body. Under no circumstances is it found after death, except in cases in which it has been taken by or administered to the deceased.

ARSENITE OF POTASH. (FOWLER'S SOLUTION.)

All the compounds formed by arsenious acid with the alkalies are poisonous. Those of potash, soda, and ammonia are soluble in water, and therefore act with more energy. The ARSENITE OF POTASH is the only preparation which here requires notice. It is used in medicine, and is well known under the name of FOWLER'S MINERAL SOLUTION, or Tasteless Ague Drop. It is made by boiling arsenious acid with carbonate of potash, the latter being in slight excess, and it is coloured with compound tincture of lavender. In the preparation of the London Pharmacopœia there are four grains of arsenious acid in a fluid-ounce (or eight fluid-drachms) of the solution. Its real strength may be affected by any impurities in the arsenious acid employed. The preparation used in Scotland is of the same strength: but that of the Dublin College is rather stronger. The action of this liquid as a poison, in large doses, is in all respects analogous to that of arsenious acid.

Symptoms and appearances.—There is, so far as I know, only one case recorded in which this solution has destroyed life. (Provincial Journal, June 28, 1848, p. 347.) A woman took half an ounce of the solution (=two grains of arsenic) in divided doses, during a period of five days, and died from the effects. There was no vomiting or purging, but after death the stomach and intestines were found inflamed. The solution is much used by the poor in the Fen districts of Cambridgeshire, as a preventive of ague. It has occasioned symptoms of poisoning when given in an overdose, but I have not heard of any case proving fatal. The domestic use of arsenic in these districts may, however, account for the occasional detection of the poison in a dead body, irrespective of criminal administration.

There is one form of poisoning by this compound which it is desirable to point out. A mixture of arsenic, soft soap, and tar-water is largely used in agricultural districts for killing the fly in sheep. This has caused death, under the usual symptoms of arsenical poisoning, in at least two instances. There is no doubt that a mixture of this kind is injurious to sheep unless very carefully used. In *Black* v. *Elliott* (Newcastle Assizes, Feb., 1859), damages were claimed for the loss of 850 sheep, said to have been poisoned by dipping them in an arsenical mixture of this description. The jury found a verdict for the plaintiff, with 1,400*l.* damages.

Analysis.—This solution has the odour of tincture of lavender, is of a reddish colour, and has an alkaline reaction. It gives at once a green precipitate (arsenite of copper) with the sulphate of copper, and a yellow precipitate with nitrate of silver.

Acidulated with hydrochloric acid, and treated with a current of sulphuretted hydrogen gas, it yields a yellow sulphuret; and when boiled with this acid and copper, a deposit is obtained which readily furnishes octahedral crystals of arsenious acid. By Marsh's process it yields arseniuretted hydrogen.

The *Arsenite of Soda* is as poisonous as the arsenite of potash. In December, 1857, three hundred and forty children belonging to an Industrial school near London were poisoned by this compound. It had been incautiously used for cleansing a steam-boiler, and had thus become mixed with the hot water which was drawn for the breakfasts of the children. The dose of arsenic taken by each child was calculated to be one grain. All recovered, although some suffered severely. (See ON POISONS, 2nd ed. p. 378.)

Fly-Water is a name applied to solutions of various arsenical compounds in water. Mixtures of this kind are formed by dissolving one part of the arsenite of soda or potash and two parts of sugar in twenty parts of water. Paper soaked in this solution, and dried, is used for poisoning flies; and perhaps this is the safest form in which arsenic can be used for such a purpose. A case of poisoning by fly-water, in which two grains and a half of arsenious acid destroyed the life of an adult in thirty-six hours, will be found reported in the Medical Gazette (vol. 39. p. 116).

ARSENITE OF COPPER, SCHEELE'S GREEN.

The poisonous properties of this compound are undoubtedly due to the arsenic which it contains; hence it may be appropriately considered with the arsenites. It is the only metallic arsenite which is met with in commerce and the arts, and it constitutes, wholly or in part, a great variety of green pigments, known as Emerald green (aceto-arsenite of copper) employed for paper-hangings, mineral green, Brunswick, Schweinfurt, Vienna, or Mitis green, &c. It is thus found in the form of oil-paint in cakes, in boxes of water colours, spread over confectionery, in wafers, in adhesive envelopes, and lastly and most abundantly, in the various kinds of green decorative papers for covering the walls of sitting and bed rooms.

Symptoms and effects.—Although the arsenite of copper is insoluble in water, it is sufficiently soluble in the acid mucous fluids of the stomach to be taken up by the absorbents, and carried as a poison into the blood. A boy, aged three years, swallowed a small capsule of Scheele's green, used by its father as a pigment. In half an hour he complained of violent colic: there was frequent vomiting, with purging, cold sweats, intense thirst, and retraction of the parietes of the abdomen. The mouth and throat were stained of a deep green colour. Hydrated sesquioxide of iron was given: in about an hour the vomiting ceased, and soon afterwards the thirst and pain in the abdomen abated. The next morning the child was well. In another case a child, a year old, ate several pieces of a cake of arsenite of copper used for colours. There was immediate vomiting of a liquid containing green-coloured particles of the arsenite, but there were no other urgent symptoms. White of egg, with sugared water, was given to it. After a short time the child became pale, and complained of a pain in the abdomen: the pulse was frequent, the skin cold, and there was great depression. Copious purging followed, soon after which the child recovered. (Galtier, vol. 1. p. 636.) In the cases of two children poisoned by confectionery coloured with this substance, the chief symptom was incessant vomiting of a light green-coloured liquid, resembling bile diluted with water. Mr. Bully, of Reading, who reports these cases (Medical Times, April 28, 1849, page 507), describes the symptoms as severe, although the quantity of poison swallowed was small. Under the use of an emetic of ipecacuanha the children recovered. Dr. Rose met with a case similar in its details (Lancet, March 5, 1859, p. 237). (See Guy's Hosp. Reports, Oct., 1850, p. 218; also Medical Gazette, vol. 43, p. 304; and Edinburgh Monthly Journal, July, 1851, p. 1; and Lancet, March 5, 1859, p. 237.) In two cases which I examined in January, 1853, a small quantity of a confectionery ornament, coloured with arsenite of copper, proved fatal to two children. The symptoms and appearances were those of poisoning by arsenious acid. The quantity taken could not have been above two or three grains. The children picked up the ornament in the street and shared it between them. The poison was spread over a layer of sugar!

In a case which was the subject of a criminal trial, this deadly compound was proved to have caused the death of a gentleman by reason of its having been employed to give a rich green colour to some blanc-mange served at a public dinner:—the person who employed it considering that emerald or mineral green was nothing more than an *extract of spinach!* It led to death under the usual symptoms, and the parties were convicted of manslaughter and sentenced to imprisonment. (*Reg.* v. *Franklin and Randall*, Northampton Summer Assizes, 1848.) Most of the colours used for confectionery are of a poisonous nature: the pink colour given by cochineal or madder is the only one which can be regarded as innocent.

Among other uses of this noxious compound, we find it employed for imparting a bright green colour to the shelves of bakers' and green-grocers' shops. An incident which occurred to myself will show that food may thus acquire an arsenical impregnation. Several loaves of bread were supplied to me, having upon the undercrust a quantity of green-coloured pigment, which on analysis turned out to be arsenite of copper, containing about fifty per cent. of arsenic! On inquiry, I found that the baker had recently painted the shelves of his shop with this pigment, and the hot loaves placed upon them had taken off a portion of the arsenical paint. It is easy to conceive that an accident of this kind, if undetected, might lead to serious results, and perhaps to erroneous suspicions. (Medical Times and Gazette, April, 1854, p. 326.)

Another alleged form of poisoning by this substance, which has attracted some attention, is as it exists in the state of vapour or fine dust applied to the membrane of the lungs, or in the state of powder as applied to the skin. A young man, after having been engaged for nine days in printing with an arsenical green pigment, was seized with irritation and watery discharge from the nose, swelling of the lips and nostrils, and headache. The next day he experienced severe colic, and great muscular weakness: but these symptoms disappeared in about eight days. It is probable that, in this case, the arsenite of copper had been taken into the body in the state of fine powder. I have since been informed that the persons who hang the arsenical papers on walls suffer from boils, inflammation of the eyes, and irritation of the nose and throat. According to M. Bouchardat (Annuaire de Thérapeutique, 1846, p. 209), the workmen who handle the emerald-green in making the papers are subject to serious disorders of health. They sometimes suffer from eruptions of the skin,—one of the local effects of poisoning by arsenic (see Assoc. Med. Journal, 1856, Sept. 6, p. 757; Sept. 20, p. 810, and ante, p. 79), with œdema (watery swelling) of the face, and boils frequently forming in the scrotum. There is irritation with discharge of fluid from the mucous membrane of the nose, and abundant salivation. In the more advanced stage there are colicky pains, headache, and prostration of strength. (See Ann. d'Hyg. 1847. vol. 2. p. 56; also a paper by Dr. Vernois, 1859, vol. 2. pp. 107, 319; and Casper's Vierteljahrs. 1859, vol. 2. p. 8; also, Journal de Chimie, Juillet, 1858, pp. 394, 397.

I have elsewhere referred to the effects on health of wall-papers loosely covered with the aceto-arsenite of copper (p. 79). This pigment contains fifty-nine per cent. of arsenic, and from some of these papers the noxious material may be easily scraped or removed by friction. A square foot may yield from twenty-eight to seventy grains of the arsenical compound, and in rooms exposing five or six hundred square feet, a large quantity of arsenic is thus distributed over an extensive surface.

It has been supposed that because persons who inhabit such rooms were not universally poisoned, and because in those who suffered, the symptoms were not like those of acute poisoning by arsenic, the effects must have been due to some other cause.

Mr. Abel, Mr. Campbell, and Mr. Phillips (the chemist of the Board of Trade), came to the same conclusion on chemical grounds, *i.e.*, such papers must be innoxious because they could not detect in the air of the rooms, or in hot air passed over arsenical paper, any crystalline arsenic in a volatile state. In December, 1858, I found that the green pigment itself was detached from the walls and diffused in a fine dust over the whole of the apartment, so that arsenic was readily detected on the cornices, the mouldings of pictures, and even on the tops of books in a book-case closed with glass-doors. (Med. Times and Gazette, Jan. 1, 1859, p. 5.) The case of a friend is there related, who suffered from inflammation of the eyes and other arsenical symptoms, as a result of dusting these books. The fact, therefore, is now affirmatively established, that those who inhabit rooms with arsenicated walls, are exposed to the risk of breathing arsenical dust and of suffering injury to health. That many do not suffer under these circumstances is no objection to this view, for, out of a hundred persons who are exposed to the emanations of lead, there are probably not more than ten who suffer from lead-palsy.

Many cases have now been published in the medical journals, clearly showing that the habitation of these arsenically-papered rooms may seriously affect health; and this has been especially noticed with respect to bed-rooms. The Registrar-General has taken up the matter, and, in opposition to the Board of Trade and the paper-manufacturers, has denounced the use of arsenical paper-hangings as dangerous to health and life. (Weekly Return, Nov. 15, 1860.) Dr. Letheby and Dr. Metcalfe have reported the details of two cases which occurred in Nov., 1860, in which one child died and another suffered most seriously, as a result of the use of these papers in a nursery. Arsenic and copper were discovered by Dr. Letheby in the stomach and liver of the deceased child. (Journal of Society of Arts, Dec. 14, 1860: and Lancet, Nov. 17, 1860, p. 494.) Dr. Lorinser states that at Vienna the arsenical green is unknowingly selected by preference for papering bed-rooms. He relates the cases of two females, in which injury to health was produced; and in one of these, arsenic was detected in the urine, thereby at once explaining the cause of the symptoms. (Journal de Chimie, December, 1860, p. 724.) Dr. Böcker, of Bonn, one of the most recent writers on Toxicology, refers to the effects of chronic poisoning produced on persons inhabiting rooms of which the walls are covered with arsenical paper-hangings, and states, that on several occasions he has been called upon to treat such cases. A removal of the cause has generally proved sufficient. Dr. Böcker considers that a damp state of the wall renders them injurious. (Die Vergiftungen, 1857, p. 132; also Casper's Vierteljahrschrift, January, 1858, p. 184.)

Arsenical papers are extensively used for lamp-shades, and for wrapping night-lights, as well as numerous articles of food and confectionery, by persons who would probably shrink from the use of white arsenic under similar circumstances. The effects which may be produced by the use of arsenical lamp-shades, have been described by Mr. Briggs, of Bath, in a case which fell under his observation. A watchmaker suffered from swelling and ulceration of the lips. These symptoms were clearly traced to the use of an arsenical shade. (Lancet, Jan. 17, 1860, p. 8.)

Sanitary reform in our dwellings appears to be chiefly directed to the removal of those vapours only which affect the sense of smell, although there are substances having no offensive odour which are liable to be inhaled, and are much more injurious in their effects on health. So difficult is it to trace out the real cause of disease, and to fix this upon the public mind, when a particular branch of trade is liable to suffer injury, that some years elapsed before the noxious effects of phosphorus on lucifer-match makers was accepted as a fact. In 1846, M. Bricheteau announced from his researches that there was not a single well-authenticated case of necrosis among the 2000 match-makers of the Paris factories! Three or four cases of disease of the jaws which he met with were referred by him to syphilis. (Lancet, March 21, 1846.) The facts which M. Bricheteau endeavoured to set aside by an imperfect investigation are now established beyond dispute. The arsenical papers have received a quasi-official support in England from the Board of Trade, while they have received the condemnation of the Registrar-General, whose especial duty it is to report on the causes which produce disease and add to the mortality of the country. If the sale of such papers is continued, it should be only on the condition of the words "arsenic—poison" being stamped upon them.

Analysis.—(Scheele's Green.) This salt is of a green colour, the depth of which is modified by admixture with other substances. It is insoluble in water, but soluble in ammonia and in acids, forming a blue solution. When very gently heated in a reduction-tube, arsenious acid is sublimed in minute octahedral crystals. These may be collected, dissolved in water and tested in the usual way. (See p. 84.) The residuary oxide of copper may then be dissolved in nitric acid, and tested for that metal. The pigment called Emerald Green, which is chiefly used for covering paper-hangings, is a mixture of arsenite and acetate of copper. The presence of arsenic in this compound is easily detected by hydrochloric acid and metallic copper. All the green arsenical papers owe their colour to it. There is a very simple method of detecting arsenic in a paper of this kind. A slip of it should be soaked in a moderately-strong solution of ammonia. The colour is removed, and the blue ammoniuret of copper is formed and dissolved in a few minutes. A crystal of nitrate of silver may now be dropped into the blue liquid. If arsenic is present, it will be indicated by the outside of the crystal acquiring a yellow colour from the production of arsenite of silver. At the top of the crystal the colour will be green, from the intermixture of the yellow and blue, but below and at the sides, the yellow colour will be well marked. (Chem. News, No. 1. p. 12.) If a strong solution of nitrate of silver is added to the ammoniacal liquid, nearly neutralized by diluted sulphuric acid, a yellow precipitate of arsenite of silver will be formed.

Arsenic Acid (Arseniates).

This is an artificial product almost entirely confined to the chemical laboratory. Orfila states that it is a more powerful poison than arsenious acid, but he does not adduce any cases in support of this opinion. I have not been able to find any case of poisoning by it in the human subject. Dr. Glover ascertained that four grains of the acid, dissolved in two drachms of water, and introduced into the stomach of a stout rabbit, killed the animal in four hours, with the symptoms of irritant poisoning, and an affection of the nervous system. (Ed. Med. and Surg. Jour., vol. 58. p. 121.)

Analysis.—Arsenic acid is a white uncrystalline deliquescent solid. 1. It is not entirely volatized on platina foil by the flame of a lamp. 2. It is very soluble in water, forming a highly acid solution. 3. It is precipitated of a brick-red colour by nitrate or the ammonio-nitrate of silver. In these characters it differs from arsenious acid. 4. It yields readily an arsenical sublimate with charcoal. 5. It yields deposits with copper and muriatic acid, or in Marsh's apparatus. But Dr. Rainey has shown that Reinsch's process does not act so delicately with arsenic as with arsenious acid. The arsenic may, however, be converted to arsenious acid by a current of sulphurous acid gas. Arsenic acid is also precipitated, although slowly and of a pale yellow colour, by sulphuretted hydrogen gas. In these properties it resembles arsenious acid. Dr. Brett has suggested, in place of using sulphuretted hydrogen gas, the addition of hyposulphite of soda and hydrochloric acid to arsenic acid or an arseniate. The arsenic acid is thus brought at once to the state of arsenious acid, and precipitated by the sulphur of the hyposulphite. The precipitation as sulphide takes place slowly in the cold, but copiously, rapidly, and completely when the mixture is heated.

The arseniates of potash and soda must be regarded as active poisons, although there are but few instances on record in which life has been destroyed by them. Dr. Christison states that, in the course of his reading, he has met with only two reported cases of poisoning by arseniate of potash (Op. cit. 284). The *tests* are the same as for arsenic acid. A coarse sort of blotting-paper, soaked in a solution of arseniate of potash, is extensively sold under the name of "*Papier Moure.*" It has been erroneously represented that the substance with which it is impregnated is not poisonous to human beings. (See Lancet, February 11, 1860; also Ann. d'Hyg. 1860, vol. 1. p. 292.)

SULPHURETS OF ARSENIC.

There are several kinds met with in commerce—ORPIMENT or YELLOW ARSENIC, and REALGAR or RED ARSENIC. They are poisonous in consequence of their containing a large proportion of free arsenious acid; this sometimes amounts to as much as 30 per cent. of their weight. They are rarely used as poisons. Orpiment is much employed in the arts, and is procurable by artisans with the most destructive facility. From its brilliant colour it is used in painting, dyeing, paper-staining, and even in the colouring of toys and sweetmeats for children! In December 1859 six persons suffered from the usual symptoms of poisoning by arsenic, owing to their having eaten *Bath buns.* It was found that the confectioner at Clifton had used, as he supposed, chromate of lead to give the buns a rich yellow colour, and make them saleable; but the druggist to whom he applied had ignorantly supplied him with orpiment. This wholesale system of poisoning is one of the attendant evils of adulterating articles of food. The *Bradford lozenge cases* (Nov. 1858) furnish a remarkable instance of the impunity attendant upon acts of this kind. A confectioner, intending to adulterate lozenges with plaster of Paris, mixed with them a quantity of white arsenic which had been supplied to him through mistake. I am informed that more than 200 persons partook of these poisoned lozenges, and suffered the usual effects. Seventeen persons died: twelve from acute poisoning, and five from the secondary effects. A trial took place, but the law could not fix the responsibility for the act upon any individual.

Symptoms and appearances.—The sulphurets of arsenic produce symptoms and appearances after death similar to those caused by arsenious acid; but the dose required to destroy life must vary according to the proportion of arsenious acid with which the sulphuret happens to be mixed. This is not a common form of poisoning; the yellow colour of the poison would lead to suspicion: but by reason of this colour it may be given or taken, by mistake, for mustard or turmeric. In a case which occurred to Dr. Jochner, two persons partook of some porridge, in which orpiment had been put, by mistake, for turmeric. They suffered from continual vomiting, burning pain in the stomach, and collapse. One, an old man, died in twenty-two hours; the other, a boy, recovered. On inspection there was violent inflammation of the gullet and stomach, the mucous coat of the latter being softened and thickened. There was a sphacelated spot, one inch in diameter, in the gullet; and another in the stomach, three inches in extent. (Wharton and Stille, Med. Jur. 434.) According to Dr. Chevers (Med. Jur. for India, p. 74), orpiment is much used in India both as a medicine and as a poison. He refers to eight instances in which this poison was found, either in food, or in the stomachs of persons who had died under symptoms of irritant poisoning. Orpiment and realgar are sold openly in India, and are used as depilatories. Orpiment has been known to cause death by *external* application as a depilatory (see Annales d'Hygiène, 1834, 459).

Analysis.—The powdered sulphurets yield a solution of arsenious acid on boiling them in water acidulated with hydrochloric acid. They readily give the well-known sublimates of metallic arsenic, both with soda-flux, silver, and in the hydrogen apparatus. They also yield a deposit of arsenic when boiled with copper and hydrochloric acid. The other properties of this compound will be found described at page 86. *Organic mixtures.*—The sulphuret being insoluble in water, it is in general easily separated mechanically by allowing the matters mixed with it to become dry upon bibulous paper. If the sulphuret cannot be separated mechanically, the organic matter suspected to contain it should be dried and boiled with nitric acid to dryness, until it is destroyed. Any sulphuret will be then found under the form of arsenic acid, soluble in water.

SOLUTION OF CHLORIDE OF ARSENIC.

(LIQUOR ARSENICI CHLORIDI.)

This is a pharmacopœial solution of arsenic in diluted hydrochloric acid. It contains one grain and a half of arsenious acid in one fluid-ounce, which is equal to the small proportion of three sixteenths of a grain to a fluid-drachm. Mr. Phillips states that it is a highly poisonous preparation, and from a case which I saw in Guy's Hospital in May, 1857, this statement is confirmed. An adult female took, in three doses, thirty minims over a period of twenty-four hours. The quantity of arsenic thus taken was not more than the *tenth part* of a *grain*, and yet the symptoms which followed were of a severe kind, resembling those of chronic poisoning. There were constriction of the throat, pain and irritation of the stomach and bowels, tingling and numbness of the hands and feet, loss of muscular power, and a feeling of extreme depression. The medicine was withdrawn, and the patient slowly recovered. It seems that she had not taken arsenic previously, and there was no evidence of the existence of a peculiar susceptibility to the effects of this poison. The quantity taken was very small to produce such alarming effects. The usual medicinal dose of this solution is from three to ten minims. It has about three eighths of the strength of the solution of arsenite of potash.

ARSENURETTED HYDROGEN.

This is a gaseous poison of arsenic, producing, when respired in small quantity, very serious effects upon the system. It has already occasioned death in at least three instances. (See ON POISONS, p. 441.)

CHAPTER 12.

CORROSIVE SUBLIMATE—SYMPTOMS—ITS EFFECTS COMPARED WITH THOSE OF ARSENIC—SLOW OR CHRONIC POISONING—SALIVATION FROM SMALL DOSES OF MERCURIAL MEDICINES—FROM OTHER CAUSES—APPEARANCES AFTER DEATH—QUANTITY REQUIRED TO DESTROY LIFE—PERIOD AT WHICH DEATH TAKES PLACE—FATAL DOSE—TREATMENT—CHEMICAL ANALYSIS IN POWDER AND SOLUTION—PROCESS IN ORGANIC LIQUIDS—CALOMEL—WHITE AND RED PRECIPITATES—SULPHURETS OF MERCURY.

CORROSIVE SUBLIMATE.

THIS substance is usually known under the chemical name of PERCHLORIDE OF MERCURY; but, according to some distinguished authorities, it is a Chloride. To prevent any confusion from scientific chemical nomenclature, the old and popular name of *Corrosive Sublimate* is here used. It is not often taken as a poison. In the Coroner's report for 1837-8, there were about fifteen cases of mercurial poisoning, in twelve of which corrosive sublimate was the poison taken. It is commonly seen under the form of heavy crystalline masses, or of a white powder. The *taste* of corrosive sublimate is powerfully austere and metallic, so that no poisonous quantity of it could be easily swallowed, without the person becoming immediately aware of it. It is very *soluble* in water, hot or cold, and speedily sinks in it, in which properties it differs strikingly from arsenic. I have found by experiment that one hundred grains of a cold saturated solution hold dissolved, at a maximum, ten grains of corrosive sublimate; and it is stated by most chemists that two parts of boiling water (212°) will dissolve one part of the poison. It is also readily dissolved by alcohol and ether; the last body takes up one-third of its weight, and has the property of abstracting it from its aqueous solution,—a principle which is sometimes resorted to for separating the poison when dissolved in organic liquids.

Symptoms.—The symptoms produced by corrosive sublimate generally come on immediately or within a few minutes after the poison has been swallowed. In the first place, there is perceived a strong metallic taste in the mouth, often described as a coppery taste; and there is, during the act of swallowing, a sense of constriction almost amounting to suffocation, with burning heat in the throat, extending downwards to the stomach. In a few minutes violent pain is felt in the abdomen, especially in the region of the stomach, which is increased by pressure. Pain in the abdomen has been sometimes wholly absent. There is nausea, with frequent vomiting of long stringy masses of white mucus, mixed with blood; and this is followed by profuse purging. The countenance is sometimes swollen and flushed, in other cases it has been pale and anxious. The pulse is small, frequent, and irregular, and is scarcely perceptible when the symptoms become aggravated. The tongue is white and shrivelled,—the skin cold and clammy, the respiration difficult; and death is commonly preceded by fainting, convulsions, or general insensibility. The external parts of the mouth when examined, are swollen, and sometimes present an appearance as if the cavity had been washed with a solution of nitrate of silver: the lips are often swollen. Suppression of urine has also been frequently noticed among the symptoms. It existed in a well-marked case of poisoning by this substance, at Guy's Hospital:—the patient lived four days, but did not pass any urine during the whole of this time. (Guy's Hospital Reports, April, 1844, p. 24.) This symptom was observed in a case reported by Dr. Wegeler (Casper's Wochenschrift, Jan. 10, 1846, p. 30), in which a youth, æt. seventeen, swallowed three drachms of the poison, and died on the sixth day. During the last three days, no urine was secreted. The case was otherwise remarkable from the fact, that no pain was experienced on pressure of the abdomen, and that the pulse underwent no change until shortly before death. In another case, reported by Dr. Herapath, in which a scruple of corrosive sublimate in solution was swallowed, suppression of urine and salivation came on on the third day, and the patient died on the ninth day. (Lancet, Dec. 13 and 27, 1845, pp. 650, 698.) In a case observed by Mr. Morris, the quantity of urine secreted was small, and it produced a scalding pain when voided. (Prov. Med. Jour. Nov. 18, 1843, p. 126.) In this instance there was no purging. The application of corrosive sublimate to tumors or ulcers may destroy life with all the usual symptoms. At the Winchester

Lent Assizes, 1859 (*Reg.* v. *Crook*), a quack was convicted of manslaughter by applying corrosive sublimate in powder to a cancerous tumour in the face of deceased. The man suffered from the usual symptoms. After death the bowels were found extensively inflamed and ulcerated. Mr. May, of Reading, detected corrosive sublimate in the cancerous tumour.

This poison differs from arsenic: 1, in having a well-marked taste; 2, in producing violent symptoms in a few minutes; and 3, in the fact of the evacuations being more frequently mixed with blood. The symptoms produced by corrosive sublimate, in the first instance, resemble those of cholera; if the individual should survive several days, they are more like those of dysentery,—violent straining, and mucous discharges mixed with blood being very frequently observed.

Slow or chronic poisoning.—The symptoms are much modified when the poison is taken in small doses at intervals for some days or weeks. There are colicky pains, with nausea, vomiting, general uneasiness, and depression. The salivary glands become inflamed and painful; the tongue and gums are red and swollen, sometimes ulcerated, and there is fœtor of the breath. A deep blue line, like that observed in poisoning by lead, is sometimes found around the edges of the gums. The patient experiences difficulty of swallowing and breathing. The constitutional effects are indicated by looseness of the bowels, difficulty of breathing, spitting of blood, cough, general tremor of the limbs, and palsy, with slow fever and emaciation, under which the patient sinks.

One of the most marked effects of slow or chronic poisoning by mercurial preparations is *salivation* or ptyalism, indicated by an increased flow of saliva. This is by no means a necessary symptom in cases of acute poisoning by corrosive sublimate, but it not unfrequently shows itself about the second or third day. In some instances the patient dies too rapidly for this effect to follow, but even when he survives some days, salivation is not always observed. In a case related by Dr. Venables, in which two drachms of the poison had been taken, and the woman survived for the long period of eight days, this symptom did not exist. In another case reported by Mr. Wood (Ed. Med. and Sur. Jour. vol. 51. p. 141), in which half a teaspoonful of the poison was taken, salivation was profuse in the course of a few hours. When the dose of this poison has been small and repeated at intervals, we may generally expect to meet with salivation, accompanied by fœtor of the breath, and sponginess and ulceration of the gums. Should the person survive some time, this symptom is more commonly met with than not; but in looking for it as an indication of mercurial poisoning, a medical jurist must remember that some persons are wholly unsusceptible of this condition. On the other hand, there are cases in which the salivary glands are most easily excited, so that the usual innocent doses of calomel or grey powder have been known to produce salivation to such a degree as to cause death.

Cancrum oris. Canker of the mouth.—Corrosive sublimate, and other mercurial preparations, are liable to produce *gangrene of the mouth* and fauces,—a state which may equally occur from spontaneous causes: death is commonly the result. In a case of this kind, supposing any mercurial compound to have been given medicinally, it may become a serious question whether death actually resulted from the mercury acting as a poison, or from natural disease. Several fatal cases have occurred among infants and children; and the subject has become a matter of inquiry before coroners. Although salivation and its consequences are not common among children, as an effect of mercurial medicines, yet it is clear, from numerous cases which are on record, that small doses of mercury may have a most violent effect upon them, and render the suspicion of poisoning probable. Of two children, whose deaths became the subject of investigation under these circumstances, one was affected with hooping-cough and the other with measles. Powders containing calomel were prescribed in both cases,—gangrene of the mouth supervened, and the children died. There was some reason to believe, from the evidence, that the mercury had really produced the effect attributed to it, at least in one of the cases. In another instance, in spite of the absence of salivation, it appears to have been produced by a drachm of mercury and chalk in a child æt. five. It proved fatal in five days. (Lancet, March 27, 1847.) It is proper to remark, that this kind of disease,—gangrene of the mouth,—has been observed to occur in children to whom no calomel, nor any mercurial preparation whatever, had been given:—the subjects have been chiefly infants, badly fed and clothed, and generally labouring under, or recovering from, fever, small-pox, measles, or hooping-cough. It is, however, far more common as a consequence of measles than of other diseases, and it is always connected with a depressed state of the vital powers. Many cases of this kind are reported by Dr. Hennis Green (see Lancet, Dec. 1839). The disease is often vulgarly called "canker of the mouth." Dr. Dugas considers that children between five and eight years of age are very liable to this form of mercurial salivation and sloughing. (Ed. Monthly Journal, May 1851, p. 481.)

Appearances after death.—These, as in the case of arsenic, are chiefly confined to the alimentary canal. Corrosive sublimate, however, affects both the mouth and throat: the mucous membrane is softened, of a white or bluish grey colour, and sometimes inflamed: that lining the gullet is similarly affected, and partially corroded and softened. The mucous membrane of the stomach is more or less inflamed, sometimes in patches;

and there are masses of black extravasated blood found beneath it. Occasionally the whole cavity has a slate-grey colour from the partial decomposition of the poison by the membrane itself; beneath this, the mucous coat may be found reddened. This grey tint of the mucous membrane has been considered by some to be indicative of the action of the poison on the living mucous membrane; but it is not always present. A case occurred at Guy's Hospital, in which the mucous membrane was simply inflamed: it much resembled the condition presented in cases of arsenical poisoning. The coats of the stomach are sometimes corroded, and so much softened that they cannot be removed from the body without laceration. Similar appearances have been met with in the small and large intestines, especially in the cæcum. In a case reported by Dr. Herapath, in which a scruple was taken, and death occurred on the ninth day, the mucous membrane of the stomach was softened, but there were no well-marked appearances of the action of the poison in this organ. The cæcum had been the seat of the most violent inflammation, the whole surface being of a deep black-red colour, and there were patches of sloughing in the coats. (Lancet, Dec. 27, 1845, p. 700.) In a case which occurred to Dr. Thomson of Perth, in which a man died forty hours after having swallowed two drachms of corrosive sublimate in powder, the mucous membrane of the stomach, duodenum, upper portion of the ileum, and parts of the large intestines, were found of a bright red colour. This appearance was most marked at the cæcum and sigmoid flexure of the colon. The local action of the poison on the mouth and throat was in this instance considerable. (Edinburgh Monthly Journal, Dec. 1851, p. 532.) Perforation of the stomach is very rare as an effect of this poison: there is, I believe, only one case on record. Certain morbid changes have been found in the urinary and circulating organs, and Mr. Swan states that he has found the ganglia and branches of the sympathetic nerve inflamed; but these changes are not by any means characteristic of this variety of poisoning. Appearances in the alimentary canal, like those just described, have been seen, not only where the case has terminated fatally in a few hours, but where it has been protracted for six, eight, and even eleven days. (Chaussier, Recueil des Mémoires, 363.) In the case of a man, æt. forty-two, who swallowed, by mistake, thirty grains of this poison dissolved, and who died on the twelfth day, the stomach was found empty, the mucous membrane was of a dull, dark red colour, chiefly about the smaller curvature. It was softened, and near the pylorus was grey, pulpy, and gangrenous. In the gullet, the lining membrane appeared to have been stripped off in shreds. The intestines were in a state of intense inflammation, passing into gangrene. The other viscera presented no particular appearance. In this case the symptoms were manifested in a few minutes: there was a burning pain down the gullet to the stomach complained of as if the parts were on fire; there was no mark of corrosion in the mouth: there was a sensation described as if the throat were "grown up;" the vomited matters contained blood, as well as the evacuations. There was no salivation at any period. (Med. Times and Gaz., Feb. 26, 1859, p. 210.)

Quantity required to destroy life.—This is a question which it is somewhat difficult to answer with any degree of certainty, since it is only by accident that the quantity taken can be ascertained, and the fatal effects must vary according to many circumstances. A child aged three years died in twenty-three days from the effects of twenty-three grains of corrosive sublimate. The *smallest* dose which is reported to have destroyed life was *three* grains. This was also in the case of a child, and the quantity was accurately determined from the fact of its having been made up by mistake for three grains of calomel, which the physician intended to order. (This case is referred to in the Lancet, 1845, p. 297.) A very loose and imperfect report either of the same or of a similar case is given in the Annales d'Hygiène, 1835, vol. 1, p. 225. It is stated that three children lost their lives. It is probable that, under favourable circumstances, from three to five grains, or even less, would destroy an adult. Persons who had taken large doses have been known to recover when remedies were timely administered, or early vomiting was produced. (Med. Times and Gaz., Feb. 18, 1860, p. 162.) I have elsewhere reported a case in which a female who had swallowed nineteen grains recovered in a few days without a bad symptom. (Guy's Hosp. Reports, Oct. 1850, p. 213.) A case of recovery after *forty grains* had been taken in whiskey under circumstances favourable to its fatal operation—*i. e.* on an empty stomach, is recorded by Dr. Andrews. (Cormack's Journal, February, 1845, p. 102.) The patient was a woman of sixty-five. The smallest dose required to destroy an adult, under ordinary circumstances, cannot, therefore, be determined at present from any reported facts. Judging from the effects produced by small quantities used medicinally, possibly the average fatal dose may not differ widely from that of arsenic—*i. e. two to three grains.*

Period at which death takes place.—In an acute case, an individual commonly dies in from one to five days; but death may take place much sooner or much later than this. A person has been known to die from the effects of this poison in eleven hours (Christison, p. 402); and in one instance of a child two years old, by whom twelve grains had been taken, death probably occurred in six hours. (Niemann's Taschenbuch, p. 451.) A case is reported in which a child, aged seven, was killed in three hours by eighteen grains of corrosive sublimate. The shortest fatal case on record was communicated to me by Mr. Welch. The quantity of poison taken was not ascertained, but the man died in less than *half an hour.* (ON POISONS, CORROSIVE SUBLIMATE.) In a case reported in the Edinburgh Monthly Journal, vol. 1, 1860, p. 958, an adult who took from sixty to eighty grains of corrosive sublimate did not die until the *twelfth day.* The case was somewhat peculiar. On the first day there was no complaint of pain in the gullet or stomach; the throat was painful on the second day, and the mouth and gums were affected on the third day. On the eighth day the man had apparently recovered, but he gradually became weaker, and died on the twelfth day.

Chemical analysis,—in the solid state.—We will first suppose that the poison is in a *solid* state, and in the form of a white powder. 1. A small quantity heated on thin platina foil is entirely volatilized at a moderate heat—(care should be taken in performing this experiment)—in this property corrosive sublimate resembles arsenic, but it differs from arsenic in all other respects. If heated in a close tube, it melts at about 560°, and is then sublimed and deposited in prismatic crystals. 2. It is very soluble in water—if the water be warmed, the powder will be dissolved instantly. 3. A small quantity of the powder dropped into a white saucer containing a solution of iodide of potassium, is turned of a bright scarlet colour. 4. Dropped into potash in a similar way, it is turned of a yellow colour. 5. Into a solution of hydrosulphuret of ammonia, it is turned black. 6. When a few grains are rubbed on a clean surface of copper, with a mixture of one part of hydrochloric acid and two parts of water, a bright silvery stain is produced, which is entirely volatilized by heat. If zinc or tinfoil be used instead of copper, the surface acquires a silvery lustre, and the metal becomes remarkably brittle. 7. When mixed with three or four parts of calcined carbonate of soda, and heated in a small tube similar to that employed in the analysis of arsenic, the metal is reduced, and a ring of bright globules of mercury is formed, while common salt remains in the tube. For the success of this experiment the materials must be quite dry, and the tube at first gently heated: any undecomposed corrosive sublimate that may be sublimed should be driven higher up, before finally applying a strong heat, so that the ring of mercury may not be obscured by it. This last experiment is conclusive of the nature of the substance; because mercury, being the only liquid metal, is the only metal which sublimes in globules. If the end of the reduction-tube, containing the fused chloride of sodium left as a residue by the decomposition, be filed off, reduced to powder, and boiled with a little diluted nitric acid, a solution is obtained in which, on the addition of nitrate of silver, chlorine may be proved to exist. The analysis is then complete. The properties mentioned under 1, 2, and 5, are possessed in common by other bodies; but the other characters are peculiar to the persalts of mercury: and when the results agree, they render it absolutely certain that the powder must be a persalt of this metal. The action of nitrate of silver upon the solution of the residue will prove that the persalt must have been a *chloride*. There are therefore no *objections* to this mode of analysis.

In solution in water.— Corrosive sublimate is very soluble in water, forming a clear solution which, when concentrated, has a faintly acid reaction and a strong metallic taste. A few drops of the solution may be first gently evaporated on a slip of glass, and then set aside to crystallize. If it be corrosive sublimate, it forms slender opaque silky prisms, sometimes of considerable length, and intersecting each other. When a weak solution of iodide of potassium is dropped on them, they acquire a bright scarlet colour, and chloride of potassium is formed. These characters, which may be obtained from the minutest crystal and only one drop of solution, prove that the body dissolved in water is corrosive sublimate: it is thus distinguished from every other mineral poison, and all other substances whatever.

Tests— 1. *Potash.*— On adding a small quantity of caustic potash to the solution, a reddish-coloured precipitate falls, becoming yellow by the addition of a larger quantity of alkali. This precipitate, when washed, dried, and heated in a reduction-tube, yields a well-defined ring of metallic mercury. The filtered liquid will be found, on being tested with nitrate of silver, to contain chloride of potassium, thus proving that the mercury was combined with chlorine, and that the compound was soluble in water. 2. *Chloride of tin.*— On adding this test in rather large quantity to the solution, a white precipitate at first falls (calomel), becoming speedily of a slate-grey colour, and afterwards almost black. On warming the liquid it soon becomes clear, while a heavy precipitate, in great part formed of pure metallic mercury, falls to the bottom of the vessel. The mercury may be collected by pouring the liquid on a filter, and afterwards drying the filter; or its presence may be easily demonstrated by pouring the water carefully from the heavy precipitate, and forcing down upon this a slip of bibulous paper:— the paper absorbs the water from the mercury, and the pressure condenses the metal into one or more well-defined globules. 3. *Sulphuretted hydrogen gas.*— This gives at first a precipitate, partly black and partly white (chloro-sulphuret), becoming entirely black when the current of gas has been allowed to pass in for some time. *Hydrosulphuret of ammonia* gives a similar precipitate in the solution; thus clearly distinguishing corrosive sublimate from arsenic. The test acts equally in an acid solution of the salt. The precipitated black sulphuret of mercury, dried and heated with carbonate of soda or metallic silver, easily furnishes a ring of pure metallic mercury. 4. *Precipitation by metals.*—If we acidulate the liquid with a few drops of diluted hydrochloric acid, and introduce a slip of bright copper, or, what is better, fine copper-gauze, it is soon coated in the cold with metallic mercury, having more or less of a silvery lustre, especially on friction. On heating the copper in a reduction-tube, the mercury may be obtained in well-defined globules. 5. *The galvanic test.* — There are various methods by which galvanism may be applied to the detection of mercury or corrosive sublimate. Dr. Wollaston, on one occasion, employed an iron key and a guinea: he placed a drop of the suspected solution on a surface of gold, and touched it and the gold with the key; — the mercury was deposited on the gold in a bright silvery stain. The following is a ready method of producing the metal :— Place a few drops of the solution on a clean surface of copper, and slightly acidulate it with muriatic acid; then touch the copper through the solution with a slip of zinc foil. Wherever the copper is touched by the zinc the mercury is deposited, and on washing the surface with diluted hydrochloric acid and weak ammonia, a silvery stain is left, which is immediately dissipated by the heat of a spirit-lamp. The experiment may be modified by twisting a slip of zinc round a slip of bright copper, or copper-gauze, and introducing them into the liquid; any change of colour or tarnish will be apparent on the copper. Mercury is deposited on both metals. A surface of gold with zinc, the gold foil or wire being external and twisted round the zinc, forms a still more delicate test of the presence of mercury than a surface of copper. Applied in a way to be presently explained, it will detect the metal when nearly every other method fails. Other tests have been proposed; but I omit all notice of them, because the foregoing are, in my opinion, quite sufficient for every practical purpose.

In liquids containing organic matter. — The same process of analysis will apply to the *vomited matters and contents of the stomach.* Masses of corrosive sublimate may be sometimes locked up in thick viscid mucus; and in such cases, the coarse powder being heavy, it may be separated by simply agitating the viscid liquid in water, and then decanting it suddenly. This poison is decomposed and precipitated by many organic principles, such as albumen, fibrin, mucous membrane,—also by gluten, tannic acid, and other vegetable substances. Thus, then, we cannot always expect to find it in the stomach, in a state of solution. We must filter in order to separate the liquid from the solid portion; and our first object will be to determine whether any of the poison is held in solution. For this purpose a portion of it may be shaken with its volume of ether in a stoppered tube, and after a time the ethereal liquid decanted, and allowed to evaporate spontaneously in a watch-glass, or other convenient glass vessel. If corrosive sublimate is present in moderate quantity, white prismatic crystals will appear, which are rendered scarlet when touched with a solution of iodide of potassium. The other properties of the poison may also be brought out by dissolving the crystalline residue in water, filtering the solution through a wet filter, and applying the appropriate tests. The quantity of corrosive sublimate may be too small for this method of separation; then we may acidulate the liquid with about one tenth part of its volume of hydrochloric acid, and introduce a slip of copper-gauze, at the same time warming the liquid. If the poison be present, even in minute quantity, the gauze will sooner or later acquire a silvery-grey colour, from a deposit of mercury. It should be well washed in water, in alcohol or ether, again in water, and then dried. On heating it in a reduction-tube, a ring of fine metallic *globules* will appear in a detached form, and having a silvery-white lustre. There is no angularity, transparency, or crystalline character about this sublimate, as in the case of arsenic. When examined by the microscope, spherical globules are seen, which are perfectly opaque by transmitted light, and of a bright silvery lustre by reflected light.

In order to remove any doubt, the ring of glass on which the sublimate is deposited may be broken up and warmed in a wide tube with a few drops of nitro-muriatic acid. On evaporating to dryness at a very low temperature (corrosive sublimate being volatile), a residue having a prismatic crystalline character remains. These are crystals of corrosive sublimate reproduced from the globules of metallic mercury. When touched with a solution of iodide of potassium they acquire a scarlet colour. In very fine sublimates this, or some corroborative experiments on their nature, are indispensably necessary.

The galvanic *gold test* may be thus applied: — Cut a slip of thin gold-foil, of about one inch in length and one eighth of an inch in width; it should be just large enough to enter into a small reduction-tube. We then twist this, in a spiral form, round a similar slip of finely laminated zinc: acidulate the suspected liquid with a few drops of diluted hydrochloric acid, — suspend the gold and zinc by a thread in the midst of it, and warm the liquid. Several such pieces may be at once, or successively, suspended in the liquid. According to the quantity of mercury present, the gold will be coated with a grey-coloured deposit, either immediately, in the course of a few hours, or not until after twenty hours. If at the end of twenty-four hours the gold retains its bright yellow colour, even after the liquid has been warmed, there is probably no mercury present in a dissolved form, or the quantity is too small to admit of detection. Supposing the gold to have lost its colour, owing to its having become completely coated, we should wash it in ether, and afterwards in distilled water, to remove any corrosive sublimate or organic matter adhering to it; it should then be dried in air, without being allowed to touch any surface, and when dry divided into two equal portions. The zinc may be in part, or wholly dissolved, and it may be renewed, if necessary. One half of the gold-foil with the deposit should now be introduced into a reduction-tube. On applying heat, a fine sublimate will soon appear in the cool part of the tube, which, if not perceptible to the eye, may be easily seen, by the aid of a common lens or of a microscope, to consist of minute globules of mercury. The other half of the gold-foil with the deposit may be boiled in a tube with a few drops of strong nitric acid. If the grey deposit was owing to mercury, it will be dissolved, and now, on dilution with water and the addition of a solution of chloride of tin, a greyish-black precipitate of mercury will be thrown down. In this experiment no more nitric acid should be used than is required to cleanse the gold. It has been proposed to use fine wires of zinc and gold in place of the foil; but the foil has the advantage of presenting a greater surface. To prevent any objection to the conclusion that mercury is present when these results are obtained, it will be necessary to test separately, and together, the gold, zinc, and nitric acid, for this metal.

Let us suppose that the filtered liquid contains no trace of a mercurial salt; we must now direct our attention to the analysis of the *insoluble matters* separated by filtration. These may be boiled in distilled water; the liquid filtered, and tested by agitating it with one third of its volume of ether. It will be found, when the analysis has not been long delayed, that most of the compounds which corrosive sublimate forms with organic matter, yield commonly sufficient poison for detection, by boiling them in water. Should water fail in extracting the poison, the substance may be brought to dryness and heated with nitro-hydrochloric acid until all the organic matter is decomposed, and the surplus acid expelled. The residue may then be digested in water, and tested for mercury by the aid of copper-gauze or of gold and zinc.

Mercury in the tissues.—The liver or other tissue is cut into small pieces, and boiled in a flask until the texture is entirely broken up, in a mixture of one part by measure of pure hydrochloric acid to six or seven parts by measure of distilled water. A small slip of copper gauze at the end of a polished copper wire is first introduced. If it acquires a light grey colour, it is probable that mercury is present. If not immediately coated, the decoction is evaporated with the copper immersed in it. The coated gauze is cleansed, washed, dried as above described, and then heated in a small tube. A minute ring of mercurial globules will be perceptible either to the unassisted eye or by the aid of a lens or microscope. The spherical form, opacity, and high metallic lustre by reflected light, are sufficient to identify a mercurial sublimate. In some late researches on the detection of mercury in the tissues, I have found that the use of gold and zinc foil in the manner above described, is the most certain and rapid method of separating this metal. (Guy's Hospital Reports, October, 1860, p. 483.) When the mercury has been brought to a state of solution, by hydrochloric acid if necessary, there is no deposit on the gold until the zinc is placed in contact with it. The deposition is greatly accelerated if the liquid is heated. Mercury is then proved to be present: 1. by the silvery grey coating which the exposed parts of the gold acquires; 2. by the sublimate of metallic globules obtained, as a result of heating one half of the coated gold; and 3rd, from the solubility of the deposit on the other half of the gold, in strong nitric acid and the grey or grey-black precipitate which the nitrate thus formed, produces with chloride of tin.

Mercury is not a constituent of the body. The discovery of it, therefore, proves that it must have been received *ab extra*. The processes above described merely show the presence of the metal, not of corrosive sublimate in the body. Whether the substance had acted as a poison or not must be determined from symptoms and appearances: whether it had been given or taken as a medicine or not, is a conclusion which must also be deduced from other circumstances. The proof that the mercury was really in the form of corrosive sublimate, could only be derived from the discovery of some undissolved portions of the solid poison in the stomach or its contents, or from a separation of the poison itself by means of ether (ante, p. 123). If dissolved, it would show a soluble salt: all the soluble salts are poisonous, and are rarely used internally as medicines. If undissolved, the absorbed mercury may have been derived from some mercurial medicine innocently taken by the deceased. Nothing is more common than to discover traces of mercury in the stomach, bowels, liver, or other organs in the dead body. No importance can be attached to this discovery in the absence of evidence that the deceased has actually suffered from symptoms of mercurial poisoning. As to the mercury found in the tissues, it may have been derived from a soluble or insoluble compound, or from exposure to the metal in various trades. If there should be any doubt about the nature of a sublimate, the corroborative test recommended in the preceding page may be employed.

A person may die from the effects of corrosive sublimate, and no mercury may be found in the tissues. A case of this kind occurred to me some years since at Guy's Hospital: and another, in which the deceased died in fifteen days from a large dose of corrosive sublimate in whiskey, has been reported by Dr. Geoghegan. On this occasion, although the local effects of the poison on the throat, stomach, and bowels, were of an intense kind, the viscera, on careful analysis, yielded no trace of mercury; the metal had been entirely eliminated. (See Med. Gaz. vol. 46. p. 253.)

Calomel.

This substance, also called chloride or subchloride of mercury, although commonly regarded as a mild medicine, is capable of destroying life, even in comparatively small doses. Several cases have occurred in which excessive salivation, gangrene of the salivary organs, and death, have followed from the medicinal dose of a few grains. There is a case reported in the Medical Gazette (vol. 18. p. 484), in which a boy, aged fourteen, was killed in about three weeks by a dose of only *six grains* of calomel. It is singular that in this case neither the gums nor the salivary glands were affected; still, considering the effects of calomel in other instances, it seems most probable that the ulceration and gangrene of the face which followed were due to it. Pereira mentions the case of a lady who was killed by a dose of twenty grains of calomel: she had previously taken a moderate dose without a sufficient effect being produced. Sobernheim states that a girl, aged eleven, took in twenty-four hours eight grains of calomel, for an attack of croup, and died in eight days from inflammation and ulceration of the mouth and throat. In another instance, which occurred to Lesser, fifteen grains of calomel produced similar effects, with excessive salivation; and this patient also died in eight days. Meckel relates that twelve grains have destroyed life. (Lehrbuch, der Ger. Med. 267.) Two cases of death from calomel, in children, are recorded in the Registration returns for 1840.

There are many other fatal cases on record, and the facts leave no doubt that calomel may, in large doses, act as an irritant poison. It was supposed that these facts might be ascribed to this compound being adulterated with corrosive sublimate; but this supposition is not well founded. It has been also suggested that calomel might be converted into corrosive sublimate, by the free muriatic acid contained in the gastric secretions; but the minute proportion in which this acid exists in the fluids of the stomach, is adverse to this suggestion. (Ed. Med. and Surg. Journal, vol. 49. p. 336.)

Calomel is known from corrosive sublimate by its insolubility in water, alcohol, and ether. It is known from white precipitate by its insolubility in acids, and by its being blackened by alkalies. A mercurial sublimate may be obtained from it by heating it with dry carbonate of soda.

White Precipitate. Ammonio-Chloride of Mercury.

A few years since it was a contested question whether white precipitate was or was not a poison: and at the Chelmsford

Lent Assizes in 1850, a woman who was indicted for administering this substance to her husband, owed her acquittal to the lenient assumption in her favour that it was not a poison. Out of fourteen cases which I have collected, in which white precipitate was taken in doses varying from a few grains to forty,—two only proved fatal; and one of these was the subject of a trial for murder (*Reg.* v. *Moore*, Lewes Lent Assizes, 1860). The symptoms which it produces are violent vomiting, cramps, purging and pain in the stomach with convulsions. After death there is more or less inflammation of the stomach and bowels. Dr. Pavy's experiments on dogs and rabbits show that this is a more formidable poison than it has been hitherto supposed to be. The greater number of recoveries were probably owing to the substance being early ejected by vomiting. Rabbits, which do not vomit, were killed by a dose of four and five grains in a few hours. After death, mercury was found deposited in various organs, but more in the kidneys than in the other viscera. (For additional facts connected with the action of this poison, see Guy's Hosp. Reports, October, 1860, p. 483.)

White precipitate is an insoluble chalky-looking compound containing about eighty per cent. of mercury. As it is sold in the shops, it frequently contains corrosive sublimate to the amount of one or two per cent. It is not used internally, but it is much employed by the poorer classes in the treatment of ringworm. It is soluble in acids, is not blackened by alkalies. and it yields a mercurial sublimate when heated with dry carbonate of soda. If boiled in a solution of potash, it evolves ammonia and yellow oxide of mercury is precipitated.

RED PRECIPITATE. RED OXIDE OF MERCURY.

This substance is poisonous, but instances of poisoning by it are very rare. The following case occurred at Guy's Hospital in 1833. A woman, aged twenty-two, who had swallowed a quantity of red precipitate, was brought in labouring under the following symptoms:—The surface was cold and clammy, there was stupor approaching to narcotism,—frothy discharge from the mouth, and occasional vomiting:—the vomited matters contained some red powder, which was proved to be red precipitate. There was considerable pain in the abdomen, increased by pressure; and there were cramps in the lower extremities. On the following day the throat and mouth became painful, and the woman complained of a coppery taste. The treatment consisted in the use of the stomach-pump, and the free administration of albumen with gluten. She left the hospital four days afterwards, still under the influence of mercury. The quantity of oxide here taken was not ascertained. Sobernheim relates a case in which a man, aged twenty-six, swallowed an ounce of red precipitate. He was speedily attacked with pain in the abdomen, nausea, purging, cramps, and general weakness. The vomited matters consisted of masses of mucus containing red precipitate. He continued to get worse, and died in less than forty-eight hours after taking the poison. On inspection, the mucous membrane was found eroded and inflamed in patches,—small particles of the poison being imbedded in it. The duodenum was in a similar state, and there was a large quantity of red precipitate in the contents of this intestine, as well as in the stomach. (Op. cit. 250.) A common opinion exists among the vulgar, that this compound is possessed of active poisonous properties, hence it is sometimes administered with criminal design.

CYANIDE OF MERCURY.

This is a substance which is but very little known, except to chemists, yet it is an active poison, and has caused death in at least two instances. In April, 1823, a person who had swallowed twenty grains of this compound (thirteen decigrammes), was immediately seized with all the symptoms of poisoning by corrosive sublimate, and died in nine days. There was continued vomiting, with excessive salivation, ulceration of the mouth and throat, suppression of urine, purging, and, lastly, convulsions of the extremities. On inspection, the mucous membrane of the stomach and intestinal canal was extensively inflamed. (Orfila, vol. 1. p. 735.) Dr. Christison quotes a case in which ten grains destroyed life within the same period of time. (Op. cit. p. 427.) As a poison, the cyanide is not much inferior in activity to corrosive sublimate, but it has no corrosive properties.

TURBITH MINERAL. SUBSULPHATE OF MERCURY.

Fatal cases of poisoning by this compound are by no means common. Although insoluble in water, it is undoubtedly an irritant poison, and is capable of causing death in a comparatively small dose. A well-marked instance of its fatal operation was communicated to the Pathological Society by Mr. Ward, in March, 1847. A boy, æt. sixteen, swallowed *one drachm* of this preparation on the night of February 19th. It produced a burning sensation in the mouth and throat, and vomiting in ten minutes. In about an hour there was paleness, with anxiety of countenance, coldness of surface, constant sickness, sense of heat and constriction in the throat, and burning pain in the stomach, with cramps. The irritability of the stomach continued in spite of treatment, and after two days there was salivation with mercurial fœtor. The gums acquired a deep bluish tint, and began to ulcerate. The patient died in about a week after he had taken the poison, without convulsions, and without suffering at any period from symptoms of cerebral disturbance. The principal appearances in the body were:—inflammation of the gullet, its mucous membrane at the lower part peeling off; the inner surface of the stomach near the two openings (cardia and pylorus) was covered with petechial spots; the small intestines were contracted, the inner coat reddened, and petechial spots were found, but chiefly in the large intestines. The parotid and submaxillary glands were swollen. Mercury was detected in the intestines. (See Med. Gaz. vol. 39. p. 474.) From this account it will be perceived that turbith mineral produces effects somewhat similar to those of corrosive sublimate, but it is less active.

NITRATES OF MERCURY.

These are corrosive poisons which are used for various purposes in the arts. They are solid white salts, easily dissolved by cold water when there is a little excess of acid present. The acid pernitrate caused death in a case reported by Mr. Bigsley in the Medical Gazette (vol. 6. p. 329). A butcher's boy dissolved some mercury in strong nitric acid, and swallowed about a teaspoonful of the solution. Soon afterwards he suffered excruciating pain in the throat, gullet, and stomach:—there was great anxiety, with cold skin, small pulse, colic, and purging. He became gradually weaker, and died in about two hours and a half. On inspection, the throat, gullet, and stomach were found corroded and inflamed. Although he survived so short a time, the mucous membrane of the stomach was of a deep red colour. I have elsewhere related a case in which the application of the pernitrate of mercury to the throat as an escharotic caused immediate death by asphyxia. (See Guy's Hosp. Reports, Oct. 1850, p. 206.) The acid nitrate of mercury has often been employed by accoucheurs as a local application in diseases of the neck of the uterus. In one instance in which it was thus used, the ordinary symptoms of mercurial poisoning showed themselves, and the patient appears to have suffered severely. (Medical Gazette, vol. 45. p. 1025.)

At the Leicester Summer Assizes, 1857, a girl was charged with administering nitrate of mercury to her mistress (*Reg.* v. *E. Smith*). The evidence showed that the accused had put the poison into some camomile tea prescribed for the prosecutrix. Only a small quantity was taken, as the tea had a nauseous taste. The symptoms were:—a burning sensation in the throat and stomach, violent vomiting, with severe pain in the abdomen. By some extraordinary blunder the girl was indicted under the statute which makes it penal to cast or throw or apply to any person any corrosive fluid, &c :—and although the words "cause to be taken" are introduced, Cresswell J. ruled that this statute implied *external*, and not internal, administration. As the indictment was wrongly laid, the accused was acquitted.

CHAPTER 13.

ON POISONING BY LEAD — SUGAR OF LEAD — SYMPTOMS — APPEARANCES AFTER DEATH—QUANTITY REQUIRED TO DESTROY LIFE—CHEMICAL ANALYSIS—LEAD IN ORGANIC MIXTURES—CARBONATE OR WHITE LEAD — CHRONIC POISONING — PAINTER'S COLIC—OXIDES—LITHARGE AND RED LEAD.

Sugar of Lead. Acetate.

This is more frequently taken as a poison than any of the other salts, although cases of acute poisoning by lead in any form are not common. The substance is commonly met with in solid heavy crystalline masses, white, or of a brownish-white colour; it much resembles loaf-sugar in appearance, and has often been mistaken for it. It has also a sweet taste, which is succeeded by an astringent or metallic taste. It is very soluble in water. Four parts of distilled water at 60° will dissolve one part; it is much more soluble at a boiling temperature.

Symptoms.—Acetate or sugar of lead is by no means an active poison, although it is popularly considered to possess a virulent action. In medical practice it has often been given in considerable doses without any serious effects resulting. Dr. Christison states that he has given it in divided doses to the amount of eighteen grains daily for eight or ten days without remarking any unpleasant symptom, except once or twice slight colic. When, however, the quantity taken has been from one to two ounces, the following symptoms have been observed :—A burning pricking sensation in the throat, with dryness and thirst,—vomiting and uneasiness at the pit of the stomach, which is sometimes followed by violent colic. The abdomen is tense, and the parietes have been occasionally drawn in. The pain is relieved by pressure, and has intermissions. There is generally constipation of the bowels. If any fæces are passed, they are commonly of a dark colour, indicative of the conversion of a portion of the lead to sulphuret. The skin is cold, and there is great prostration of strength. When the case is protracted, the patient has been observed to suffer from cramp in the calves of the legs, pain in the insides of the thighs, numbness, and sometimes paralysis of the extremities. The affection of the nervous system is otherwise indicated by giddiness, torpor, and even coma. A well-marked blue line has been noticed round the margin of the gums, where they join the teeth.

A remarkable series of cases of poisoning by acetate of lead has been reported by Mr. Bancks, of Stourbridge. (Lancet, May 5, 1849, p. 478.) By some accident, about thirty pounds of this substance were mixed at a miller's with eighty sacks of flour, and the whole was made into bread by the bakers and supplied as usual to their customers. It seems that no fewer than five hundred persons were attacked with symptoms of poisoning after partaking of this bread. In a few days they complained of a sense of constriction in the throat and the pit of the stomach, violent crampy pains round the navel, rigidity of the abdominal muscles, a dragging pain in the loins, and cramp with paralysis of the lower extremities. There was obstinate constipation, and the urine was scanty and of a deep red colour. The pulse generally was slow and feeble; the countenance anxious and sunken, frequently of a peculiar livid hue; tongue flabby; gums marked by a deep blue line. The surface was cool, and there was a general arrest of the secretions. Sickness was not a uniform symptom, and even when it existed at first, it speedily subsided. The mental faculties were undisturbed. Not one of the cases proved fatal, but among the more aggravated, there was great prostration, with collapse, livid countenance, universal cramps, numbness, and other alarming symptoms. After apparent convalescence, some of the symptoms returned in a more aggravated form without any obvious cause, and for a long time the patients were out of health. Inflammation was not observed. Purgative medicines were found most effectual in the treatment. The quantity of acetate of lead taken by each person could not be determined, as, on analysis, the samples of bread were found to be very unequally impregnated with the poison.

Even when the patient recovers from the first symptoms, the secondary effects often last for a considerable time. Mr. Gorringe has recorded the cases of two girls, each of whom swallowed an ounce of the acetate of lead by mistake. Soon afterwards they felt a burning pain in the mouth, throat, and stomach and in a quarter of an hour they vomited freely: in half an hour, there was severe pain in the bowels, with purging. Under treatment recovery took place. (Prov. Med. Journ. April, 1846.) After the lapse of a year, they both suffered from severe pain in the pit of the stomach, which was tender on pressure. Nothing could be retained on the stomach; and there was a choking sensation in the throat, with other constitutional symptoms. Paralysis and other symptoms of nervous disorder are, however, by no means necessary consequences. A girl who had swallowed sixty grains of acetate of lead, and suffered severely from the primary symptoms, recovered in about three weeks without any paralysis or other disorder affecting the muscular system. (Lancet, April 4, 1846, p. 384.) This lead-palsy appears to be a more common consequence of chronic poisoning; *i. e.* of small doses repeated at intervals.

Appearances.—In one acute case related by Dr. Kerchhoffs, the mucous membrane of the stomach was found removed in several places, especially near the pylorus or intestinal opening; and most of the intestines were in a state of high inflammation. A trial for murder by this substance took place at the Central Criminal Court, in November 1844 (*Reg.* v. *Edwards.*) The stomach and intestines are stated to have been found inflamed, and there were dark spots on the former. In animals, according to Dr. Mitscherlich, when the dose is large, the mucous coat of the stomach is attacked and corroded; this change appears to be purely chemical, and takes place in all the organs of the body with which the salt of lead comes in contact. If given in a small dose, it is decomposed by the gastric secretions, and exerts no corrosive power on the mucous membrane. When the acetate of lead was given in a state of albuminate dissolved in acetic acid, death took place with great rapidity; but on inspection, the stomach was not found corroded. This corrosive action belongs to the neutral salt, and is not manifested when the dose is small or when the poison is combined with an acid.

Quantity required to destroy life.—Nothing is accurately known concerning the *fatal dose* of sugar of lead. The facts already detailed show that it may be taken in comparatively large quantity without producing serious effects. Thirty and forty grains have been given daily, in divided doses, without injury. The following additional cases, in some of which recovery took place under disadvantageous circumstances, prove that the acetate of lead is far from being a virulent poison:—Dr. Iliff met with an instance in which *an ounce* was swallowed in solution. The symptoms were pain in the abdomen resembling colic, vomiting, rigidity, and numbness. It was three hours before any remedies were used, and five hours before the stomach-pump was employed; but the person recovered. In the second case, also, an ounce was swallowed: sulphate of magnesia was freely exhibited, and the stomach-pump was used. On the following morning there was slight excoriation of the gums, which were white, with a sensation of heat in the throat: the bowels were relaxed, probably from the effect of the medicine. The day following, there were pains in the calves of the legs and thighs, with restlessness and thirst. In a week the woman perfectly recovered. In a case which occurred to Dr. Alderson, a man swallowed an ounce of the acetate of lead in a drunken fit. There was violent vomiting, and the man recovered.

Chemical analysis. Acetate of lead as a solid.—1. If a portion of the powder is heated in a small reduction-tube, it melts, then becomes solid: again melts, acquiring a dark colour, and gives off vapours of acetic acid; a black mass is left in the tube, consisting of carbon and reduced metallic lead. There is no sublimate formed. 2. It is very soluble in water, even when cold; common water is turned milky by it, from the presence of carbonic acid and sulphates. 3. A small portion of the powder dropped into a saucer containing a solution of iodide of potassium acquires a fine yellow colour. 4. When dropped into caustic potash it remains white. 5. Into sulphuretted hydrogen water or hydro-sulphuret of ammonia, it is turned black, in which respect it resembles the white salts of some other metals. 6. When the powder is boiled in a tube with diluted sulphuric acid, acetic acid, known by its odour and volatility, escapes. All these properties taken together, prove that the salt is the acetate of lead.

Acetate of lead in solution.—If acetate of lead be presented in a state of solution, or if the solid salt be dissolved in water for the purpose of making further examination, we should note the following points. 1. A small quantity, slowly evaporated on a slip of glass, will give white and opaque prismatic crystals, which are turned yellow by iodide of potassium, and black by hydro-sulphuret of ammonia. The solution is said to be neutral; but I have found the common acetate of lead to have at the same time both an acid and (with rose paper) an alkaline reaction, *i. e.* reddening litmus-paper, and turning rose-paper green, a circumstance which might create some embarrassment in an analysis. 2. *Potash*, added to the solution much diluted with water, throws down a white precipitate, which is easily soluble in an excess of the alkali. 3. *Diluted sulphuric acid* produces an abundant white precipitate, insoluble in nitric acid, but soluble in hydrochloric acid and in a large excess of potash. 4. It is precipitated of a bright yellow colour by the *Iodide of potassium;* the yellow iodide of lead is soluble in potash, forming a colourless solution. It is also dissolved by concentrated hydrochloric acid. 5. *Hydro-sulphuret of ammonia* or sulphuretted hydrogen gas, produces a deep black precipitate, even when less than the 100,000th part of the salt is dissolved. 6. Place a few drops of the solution on clean platina foil,—acidulate it with acetic acid, then apply, through the solution, to the surface of the platina, a thin polished slip of zinc:—bright crystals of metallic lead are instantly deposited on the zinc: by this method a small quantity of lead may be detected.

Lead in organic mixtures.—The acetate of lead is precipitated by many organic principles, especially by albumen and tannic acid. Thus, we may have to analyze either an organic liquid containing lead, or a solid precipitate consisting of mucus or mucous membrane, intimately united to oxide of lead. The liquid must be filtered and examined by a trial test, *i. e.* either by adding to a portion, sulphuric acid, or by exposing bibulous paper, dipped into the suspected liquid, to a free current of sulphuretted hydrogen gas. If the paper is not stained brown, there is no perceptible quantity of lead dissolved;—if it is stained brown, we dilute the liquid if necessary in order to destroy its viscidity, and pass into it a current of washed sulphuretted hydrogen gas until all chemical action has ceased. The black sulphuret of lead should be collected on a filter, washed and dried, then boiled for a quarter of an hour in a mixture of one part of nitric acid, diluted with four parts of water. This has the effect of transforming it, at least in part, to nitrate of lead soluble in water. This liquid, when filtered, may be evaporated to dryness, and the residue dissolved in water, or it may be at once cautiously neutralized by potash (free from lead) or by ammonia, and the tests added. If the quantity is too small for the application of all the tests, we may add sulphuric acid; should a white precipitate be formed, soluble in potash (free from oxide of lead), and this alkaline solution be again turned black by hydro-sulphuret of ammonia, this is sufficient evidence of the presence of lead. Should there be no lead dissolved, we must decompose the solid and insoluble matters in nitric acid slightly diluted, at a boiling temperature, filter, and test the filtered liquid, previously neutralized; or we may evaporate to dryness, destroy the organic matter by heat and redissolve the residue in nitric acid for testing.

GOULARD'S EXTRACT. SUBACETATE OF LEAD.

Symptoms and effects.—This substance has caused death in at least four instances,—one in France and three in England. Dr. Aldis describes the case of a woman, æt. twenty-one, who swallowed about three quarters of a pint of Goulard's extract of lead (strength not stated), having begun with small doses. When first seen she was in great agony. There was severe colicky pain in the abdomen which she rubbed frequently, and the muscles of the belly were drawn inwards. The pulse was feeble, there was trembling of the hands, and she was in constant motion with her body from severe suffering. There was heat in the throat and abdomen with intense thirst, and a desire to vomit, but there was no vomiting or purging. A dose of sulphate of magnesia produced vomiting and she recovered; but there remained obstinate constipation of the bowels. (Lancet, Jan. 14, 1860.)

GOULARD WATER is nothing more than a mixture of one drachm and a half of this solution to a pint of water.

Carbonate of Lead.

Symptoms.—A case of poisoning by the carbonate of lead was reported, in October 1844, to the Westminster Medical Society, by Dr. Snow. A child aged five years ate a portion not so large as a marble, ground up with oil. For three days he merely suffered from pain in the abdomen, and costiveness. On the third night, the child became rapidly worse, and there was vomiting. He died ninety hours after taking the poison, having passed some offensive motions of a greenish-black colour (probably from admixture with sulphuret of lead) before he died. The mucous membrane of the stomach was much inflamed, and of a dark-red colour throughout. Lead could not be detected in the contents or tissues of the stomach, or in the matter vomited. It is remarkable that in this case so small a quantity should have proved fatal without exciting any marked symptoms of irritation in the first instance. A young man, æt. twenty, was recommended to take chalk on account of acidity and heartburn. He took by mistake a piece of carbonate of lead, and ate about five or six drachms of it. After a few hours he complained of violent burning pains in the stomach, with vomiting. Twenty-four hours afterwards, when first seen, he suffered from violent pain, particularly in the pit of the stomach and the navel. His face was red and swollen, his eyes shining and prominent; his tongue and mouth dry and very red; abdomen distended and extremely sensitive to superficial pressure, whilst stronger pressure alleviated the pain; great thirst; the bowels were constipated. Sulphate of magnesia dissolved in water, with one scruple of tincture of opium, was given to him, and larger doses of the same salt to be repeated with an oily emulsion, by which means the patient soon recovered. (Casper's Wochenschrift, No. 36, 1844.) Most of the cases of poisoning by carbonate of lead have been of a chronic character.

Chronic poisoning. Colica pictonum, or *Painter's Colic*, may be considered as the chronic form of poisoning by carbonate of lead. It is often difficult to trace the cause, so slowly and insidiously are the effects manifested. In some instances the poison is received through the lungs, although no physical or chemical evidence of this mode of introduction can be obtained. In another work (On Poisons, 2nd. ed., p. 485) I have referred to cases in which colic and paralysis have occurred in persons who had slept in newly painted rooms. Dr. Alderson mentions several instances of this kind. (Lancet, Oct. 30, 1852, p. 391.) I have myself suffered from a severe attack of colic as a result of sitting in a room for a few hours a day in which a large surface of canvas for an oil-painting had been covered with white lead and drying oil. The late Mr. J. Lizars, of Edinburgh, communicated to me the following case: A military officer, æt. fifty, fond of painting in oil-colours, worked for some time in a room eight feet square which had a large stove in it. He was attacked with wrist-drop (paralysis) in December, 1855, and soon afterwards with paralysis in both legs. It appears that his servant always ground his colours, mixed them, and cleaned his brushes. He had had an attack some years before; but from this, by laying aside oil-painting, he completely recovered. In these instances the emanations of lead must have been received through the lungs. Doubtless chemists might be found who would undertake to prove, by ingeniously devised experiments, that there was no lead in the air of the room; and coupling these results with the fact that few artists are known to suffer from such symptoms, would contend that lead was not the cause. The symptoms, however, were of the character peculiar to lead-poisoning, and as they disappeared on the removal of the patient to another atmosphere, there could be no doubt about the cause. These insidious effects of lead should be borne in mind by those who deny that any noxious emanations can proceed from arsenical papers in inhabited rooms, merely because the greater number of persons who live in them do not suffer, and because some chemists have affirmed that they could detect no arsenic in a volatile state in the atmosphere of the room. Among white-lead manufacturers the carbonate finds its way into the system either by the skin, the lungs, or both together; — it is diffused in a fine powder through the atmosphere, and thus enters into the lungs. It has been remarked in France, that in manufactories where the powder was ground dry, not only have the labourers suffered, but horses, dogs, and even rats have died from its effects: the rats have been affected with paralysis in their hind legs. Since the practice has arisen of grinding the carbonate of lead in water, cases of colica pictonum have not been so numerous.

Men employed in the manufacture of pottery or glazed cards are liable to attacks of this kind. There are numerous other cases in which lead, or its preparations, by mere contact with the skin, have been known to produce the usual results of lead-poisoning. Mr. Scanlan communicated to me a case in which an infant was paralyzed by reason of its having been washed with water containing a finely diffused oxide and carbonate of lead. Dr. Todd mentions the case of a man in King's College Hospital who suffered from lead-palsy: he had been a potman, and the palsy was attributed to the constant handling of and cleaning of pewter pots. (Med. Gaz. vol. 48. p. 1047. For another case, see Lancet, Jan. 21, 1860, p. 60.) The mere handling of lead, or its oxides, is therefore sufficient to produce all the effects of chronic poisoning. I have been informed of a case in which a tea-dealer was seized with symptoms of lead-poisoning, and the cause remained long unsuspected, until he admitted that, in the course of his trade, he had the idle habit of often placing pieces of tea-lead in his mouth and crushing the metal between his teeth. One cause of lead-palsy among infants may be the use of farinaceous food wrapped in lead-foil having a thinly tinned surface. I have found such infants' food to be strongly impregnated on the outside with carbonate of lead. (See ON POISONS, 2nd ed. p. 505.) Snuff and tobacco, chocolate, and other substances in ordinary use, are frequently wrapped in spurious tin-foil. If the articles are kept in a damp place, they may thus become impregnated with carbonate of lead. (For an account of the causes as they affect mariners, see Ann. d'Hyg., 1859, vol. 1. pp. 95 and 296.) In a case which was under Dr. Rees at Guy's Hospital, in January 1861, no source of lead could be traced, although the symptoms were those of chronic lead-poisoning, and lead was found in the urine. Cosmetics and hair-dyes containing preparations of lead, may also produce dangerous effects. I have met with an instance in which paralysis of the muscles on one side of the neck arose from the imprudent use of a hair-dye containing litharge. Mr. Lacy has pointed out the injury to health which is likely to follow the use of white lead as a cosmetic by actors. (Medical Times and Gazette, Aug. 1852, p. 223. See also Ann. d'Hyg., 1861, vol. 1. pp. 342 and 389.)

Symptoms and appearances.—The symptoms of chronic poisoning by lead are well marked. There is first pain, with a sense of sinking commonly in or about the region of the navel (the seat of the colon). Next to pain there is obstinate constipation, retraction of the abdominal parietes, loss of appetite, thirst, fœtid odour of the breath, and general emaciation, with paralysis of a peculiar kind affecting the extensor muscles, and causing a dropping of the wrist, or showing itself in a general paralysis of the limbs. The skin acquires a sallow or earthy colour, generally well marked in the face, and the patient experiences a saccharine, styptic, or astringent taste in the mouth. A symptom of a peculiar nature has been pointed out by the late Dr. Burton and others (Med. Gaz. vol. 25. p. 687), namely, a *blueness* of the edges of the *gums*, where these join the bodies of the teeth: the teeth are of a brownish colour. Dr. Chowne considered that the presence or absence of this blue line was not connected with the administration or non-administration of lead (Lancet, Oct. 26, 1844). It has, however, been so frequently observed, that most pathologists now regard it as an established pathognomonic symptom. Dr. Chambers affirms that the blue line on the gums is an early consequence of lead-poisoning in any form, and is a distinguishing sign of lead-colic. A gas engineer, who had worked for eighteen years in his trade, had during this time used a quantity of red and white lead for various purposes. It was, however, only within the last eighteen months of this time that he had felt any ill effects from it. He had then suffered from the usual symptoms of lead-poisoning. (Lancet, Jan. 21, 1860, p. 60.) It is worthy of note in this case, that although the person had been so many years exposed to the causes of lead-disease, he did not suffer from any symptoms until the latter part of the time. A blue mark around the edges of the gums has been noticed in some cases of poisoning by mercurial preparations; and it is possible that in an advanced stage of chronic poisoning by lead it may be absent (see a case by Mr. Fletcher, Med. Times, Feb. 14, 1846, p. 395):—as where, for example, the individual has ceased to expose himself to emanations of lead. Many facts tend to show that it is an early symptom. This disease often kills the patient; and after death the large and small intestines are found much contracted, and their coats thickened. These changes have been especially observed in the colon.

The most frequent cause of chronic lead-poisoning is the use of water kept in leaden cisterns or pipes. For an instructive series of cases showing the effects of water so poisoned I must refer the reader to a paper, by Dr. de Mussy, published in the Dublin Quarterly Journal for May 1849; also Medical Gazette, vol. 44. p. 260. These cases occurred at Claremont, in the members of the ex-Royal Family of France. The effects were traced to the use of pure water which had acquired an impregnation of lead by contact with that metal, in the proportion of one grain to the imperial gallon. Thirteen out of thirty-eight persons were affected, and to such a degree, that the nails of the toes and fingers acquired a bluish discolouration. The children of the family did not suffer.

For an account of the circumstances under which water is liable to be poisoned with lead, and the effects produced by the use of such water, I must refer the reader to my work ON POISONS, p. 506.

Analysis.—Carbonate of lead is a solid white powder, insoluble in water, and immediately blackened by sulphuretted hydrogen or hydro-sulphuret of ammonia. 1. When heated on platina, it leaves a residue of yellow or orange-coloured oxide of lead, soluble in nitric acid. 2. The carbonate is easily dissolved with effervescence, by diluted nitric acid—a fact which shows that it contains carbonic acid. The oxide of lead, combined with nitric acid, may be readily detected in the solution by the tests already mentioned. This salt of lead is sometimes contained in small proportion in loaf sugar, owing to the moulds in which the loaf is set to crystallize being painted with white lead, and a portion being thus mechanically taken up. This is a noxious practice, and ought to be prohibited.

Oxides of Lead.

The yellow oxide (massicot), and the brown oxide (peroxide), are but little known except to chemists. *Litharge* and minium or *Red lead* are, however, much employed in the arts, and have sometimes given rise to accidental poisoning. In October, 1849, a woman who had swallowed two and a quarter ounces of the red oxide of lead, was admitted into Guy's Hospital. No symptoms appeared for nine hours. There was then colicky pain, with urgent vomiting, followed by head-ache and general tenderness of the abdomen. She entirely recovered in about twelve days. (Guy's Hospital Reports, October, 1850, p. 209.)

Liquids used for culinary or dietetic purposes, especially if they contain a free *acid*, are liable to become impregnated with oxide of lead, derived from the glaze of the vessel in which they are kept, and thus form poisonous salts. If vinegar be used, acetate of lead may result. Litharge-glaze is also easily dissolved by alkaline or *fatty* substances. The eating of dripping, or the fat of meat baked in a newly-glazed vessel, has been known to give rise to a slight attack of colic; while the symptoms were referred by the person to some substance mixed with the food. For cases of this kind see the Medical Gazette, vol. 47, page 659; see also Lancet, 1860, vol. 1, p. 962. I am indebted to Mr. Procter, of York, for the particulars of a case of some novelty, in reference to the contamination of food with lead. In July, 1852, four men partook of rhubarb-pie and milk for supper; shortly afterwards they were all seized with violent vomiting and intense colic. A portion of the vomited matters and food was examined by Mr. Procter, and lead was detected in them. The only source to which the lead could be traced, was the glaze of the pans in which the milk was kept. Lead pipes are largely used by publicans for the supply of beer. It is possible, therefore, if the beer is acid, and is allowed to remain some time in the pipe, it may acquire an impregnation of lead, which might give rise to colic and other unpleasant symptoms. When liquids of this kind are impregnated with oxide of lead, the fact is immediately known by their being turned of a brown colour by hydro-sulphuret of ammonia. All newly-glazed vessels yield traces of lead, more or less, on boiling in them vinegar, pure acetic acid, or a solution of pure potash. In this manner the poisonous nature of the glaze may be tested:—the oxide of lead being dissolved either by the acid or the alkali. I have found common acetic acid itself containing, as impurity, two per cent. of acetate of lead. Litharge was formerly much used to remove the acidity of sour wine, and to convey a sweet taste. Acetate of lead, or some other vegetable salt of the metal, is in these cases formed; and the use of such wine may be productive of alarming symptoms. Many years since a fatal epidemic colic prevailed in Paris, owing to this cause:—the adulteration was discovered by Fourcroy, and it was immediately suppressed. Wine thus poisoned is known by its being blackened by hydro-sulphuret of ammonia. Snuff has been adulterated with red lead: in one instance this mixture is supposed to have caused death: in other cases it has given rise to paralysis and other serious symptoms. (Medical Gazette, vol. 32. p. 138; also Annales d'Hygiène, 1831, vol. 2. p. 197; Lancet, Jan. 21, 1860, p. 60.)

CHAPTER 14.

COPPER—BLUE VITRIOL. SYMPTOMS. APPEARANCES AFTER DEATH—TREATMENT. POISONING BY VERDIGRIS—SUBCHLORIDE OF COPPER — CARBONATE — CHEMICAL ANALYSIS — TESTS — SPECIAL CHARACTERS OF THE SALTS. COPPER IN ORGANIC LIQUIDS — IN ARTICLES OF FOOD.

All the salts of copper are poisonous. The two most commonly known in commerce are the Sulphate or Blue Vitriol, and the Subacetate or Verdigris. The former has been frequently taken and administered in large doses for the purpose of suicide and in attempts at murder. In the latter case the attempt has been immediately discovered, owing to the strong metallic taste possessed by the salt. This would in general render it impossible that the poison should be taken unknowingly. With the exception of these salts, poisoning by copper is usually the accidental result of the common employment of this metal for culinary purposes. There is one copper salt—the Arsenite (Scheele's Green)—which chiefly owes its poisonous properties to arsenic. This has been elsewhere considered (page 107).

Sulphate of Copper. *Symptoms.*—Sulphate of copper has been frequently given for the purpose of procuring abortion. In doses of half an ounce and upwards, it acts as a powerful irritant on adults, and a much smaller quantity would suffice to destroy infants or children. The salt speedily induces vomiting of the most violent kind; this sometimes expels the poison from the stomach, and the person recovers. The *vomited* matters are remarkable for being generally of a *blue* or *green* colour; and broken crystals of blue vitriol were discovered in them in a case in which the poison was taken in a loosely pulverulent state. If the green colour of the vomited liquids be owing to altered bile, it will not acquire a blue tint on adding to a portion of the liquid a strong solution of ammonia; but if it be caused by a salt of copper, this change of colour will serve to indicate the fact. There is head-ache, pain in the abdomen, with purging; the pain is of a colicky character; and in aggravated cases there are spasms of the extremities and convulsions. Dr. Percival met with a case in which violent convulsions were produced in a young female by two drachms of the sulphate of copper. Paralysis, insensibility, and even tetanus, have preceded death, when the poison was administered to animals. Among the symptoms casually met with in the human subject, may be mentioned jaundice. This has been observed to attend poisoning by the sulphate, as well as by Scheele's green. The medicinal dose of sulphate of copper as an emetic, is from five to fifteen grains, and as a tonic from one to three or four grains.

There are but few instances in which this poison has proved fatal in the human subject. In 1836 a girl, sixteen months old, put some pieces of *Blue stone* (sulphate of copper), which were given to her to play with, into her mouth. In a quarter of an hour the child vomited a bluish-green coloured matter, with pieces of sulphate of copper in it; the skin was alternately cold and hot, but there was neither purging nor convulsions. The child died in *four hours*, and was insensible before death. (Medical Gazette, vol. 18. p. 742.) Unfortunately no inspection of the body was made; and yet, in the event of murder being committed by the administration of this substance, it will be somewhat unreasonably expected that medical witnesses should be fully acquainted with the appearances produced by it!

Appearances.—In poisoning by the salts of copper, the mucous membrane of the stomach and intestines has been found more or less thickened and inflamed in the few fatal cases which have been hitherto examined: the membrane has been also found eroded and softened in poisoning by verdigris. The gullet has presented an inflammatory appearance. In a case of poisoning by verdigris, quoted by Orfila, the stomach was inflamed and thickened, especially towards the pylorus (the intestinal opening), the orifice of which, from the general thickening, was almost obliterated. The small intestines were throughout inflamed, and perforation had taken place, so that part of the green liquid was effused into the abdomen. The large intestines were distended in some parts, and contracted in others, and the rectum was ulcerated on its inner surface. (Toxicologie, vol.

1. p. 623.) The lining membrane of the alimentary canal has been found throughout of a deep green colour, owing to small particles of verdigris adhering to it. It has been said that this is an uncertain character of poisoning by copper; since a morbid state of the bile often gives a similar colour to the mucous membrane of the stomach and duodenum. This objection cannot apply when the green colour is found in the gullet, and throughout the intestines: and, under any circumstances, the evidence from the presence of a green colour would amount to nothing in the judgment of a prudent witness, unless copper were freely detected in the parts so coloured. It is well to remember that the green stain, if due to copper, would be turned blue by ammonia.

VERDIGRIS. SUBACETATE OF COPPER.—This salt produces *symptoms* somewhat similar to those caused by the sulphate. There is a strong styptic metallic taste, with a sense of constriction in the throat, followed by severe colicky pains, — vomiting of a green-coloured liquid, and purging, with violent straining. In a case reported by Pyl, a woman who swallowed *two ounces* of verdigris died in three days: in addition to the symptoms above described, there were convulsions and paralysis before death. Niemann relates that a female, aged twenty-four, swallowed *half an ounce* of verdigris, and died under symptoms of severe irritation of the stomach in sixty hours. (Taschenbuch, p. 458.) In consequence of the great uncertainty of its operation, subacetate of copper is not employed internally.

SUBCHLORIDE OF COPPER.—This is a rich green compound, known as Oxychloride or BRUNSWICK GREEN. It is formed when common salt has been used in a copper vessel, and has thus given rise to accidental poisoning. It is used as a pigment for ornamenting confectionery. It generally contains arsenic derived from metallic copper.

CARBONATE OF COPPER. — A case of poisoning by this substance has been reported by M. Desgranges, of Bordeaux. A man died in about six hours, as it was supposed, from the effects of an unknown quantity of this poison which he had taken. He had sustained some violence from a fall, and when first seen he was in a state of complete stupor, and there was great coldness of the extremities. There was neither vomiting, purging, nor pain in the abdomen on pressure. On inspection, the gullet and stomach were covered with a green-coloured substance. The larger extremity of the stomach was vascular, and the mucous membrane of the intestines, as well as the liquid contained in them, was green. Carbonate of copper was found in the stomach, and traces of the metal existed in the urine—none was found in the blood. (Med. Gaz. vol. 31. p. 495.) It is remarkable that in this case there should have been neither vomiting nor purging. The carbonate seems to have acted more like a narcotic or cerebral than an irritant poison.

Chemical Analysis of the Salts of Copper.—The salts of copper are generally known by their colour: whether in the solid state, or in solution, they are either blue or green. The salts of one other metal are also of a green colour, namely nickel; but there are striking chemical differences between the salts of this metal and those of copper. There are *three* very *soluble* salts of copper; two of these are blue, the sulphate and nitrate, —and one green, the chloride. The solutions of the cupreous salts have generally an acid reaction. The salt should be dissolved in water, diluted, and the following tests may then be applied.

Tests.—1. *Solution of ammonia*: this gives, in a solution of copper, a bluish-white precipitate, which is soluble in an excess of the test, forming a deep violet-blue liquid. 2. *Ferrocyanide of potassium* gives a rich claret-red precipitate: if the quantity of copper be small, the liquid acquires merely a light-red colour; if large, the precipitate is of a deep red-brown colour, and of a gelatinous consistency. The ferrocyanide of potassium will act on the violet-blue solution produced by ammonia, provided it be much diluted or an acid added (sulphuric) to neutralize the ammonia. One portion of the liquid may thus be tried by the two tests. 3. *Sulphuretted hydrogen gas*, or hydro-sulphuret of ammonia, gives a deep chocolate-brown precipitate, even in an acid solution; or if the copper be in small proportion merely a light-brown colour. 4. A slip of *Polished Iron* (a common needle) suspended by a thread in the liquid, is speedily coated with a layer of copper, even when the salt is in very small proportion. When much diluted, a drop of diluted sulphuric acid may be added. If the needle be left for some days in the liquid, the iron will be slowly removed, and a hollow cylinder of metallic copper will remain. This may be dissolved in diluted nitric acid, and tested with the foregoing tests; or the needle coated with copper, may be immersed in ammonia and exposed to air. The liquid then becomes slowly blue. Half a grain of sulphate of copper dissolved in sixteen ounces of water may be thus easily detected. It was long since proposed by Orfila to substitute phosphorus for polished iron. This substance most effectually separates metallic copper from its salts, even when they are dissolved in organic liquids. 5. *The Galvanic test.*—If a few drops of the copper-solution be placed on platina-foil, slightly acidulated with a diluted acid, and the platina be then touched through the solution with a thin slip of zinc, metallic copper, of its well-known red colour, is immediately deposited on the platina. When the quantity of copper is small, there is merely a brown stain; but a blue liquid is formed by pouring on it ammonia, and exposing it to air. A coil of fine platina and zinc wire may be substituted for the foil.

Copper in organic liquids.—The oxide of copper is liable to be precipitated by certain organic principles, *e.g.* albumen, fibrin, and mucous membrane: but some of these organic compounds are easily dissolved by acids, or even by an excess of the solution of cupreous salt. A portion at least of the salt of copper is, therefore, commonly held dissolved. In such cases there is one peculiar character possessed by these liquids, *i.e.* they have a decidedly *green colour* even when the copper-salt is in a far less than poisonous proportion. The sulphate of copper, used in medicine and chemistry, generally contains traces of arsenic. About ten grains of the crystallized sulphate will be sufficient to yield evidence of the presence of this poison. When the sulphate has been given as an emetic, traces of arsenic may be found in the contents of the stomach or in the matters vomited.

Separation by iron.—We first filter the liquid, and save the insoluble portions for a separate operation. We may use as a trial-test either a needle, zinc with platina wire, or add to a portion, oxalic acid: the last gives a bluish-white precipitate only when the copper is in a moderately-large quantity, and the liquid is not very acid. If the needle be not coated with copper in the course of a few hours, it is certain that there is no detectable quantity of the poison present in the liquid.

Separation as a sulphuret.—If the copper-salt is present in *large* quantity, any of the trial-tests will indicate it immediately. We destroy the viscidity of the liquid by diluting it and filtering it if necessary; we then pass into it a current of sulphuretted hydrogen gas in order to precipitate all the copper in the state of sulphuret. The black sulphuret may be collected, washed, dried, and boiled in equal parts of nitric acid and water for a quarter of an hour. Nitrate and sulphate of copper are produced and dissolved,—a fact indicated by the liquid acquiring a rich blue colour: and some sulphur is at the same time separated. This liquid, when filtered, will give the usual reactions with the tests for copper.

Separation by platina.—The following is an expeditious and simple method of obtaining copper from organic liquids which contain the soluble poisonous salts of this metal. Having filtered the liquid, let a portion of it be placed in a clean platina capsule or crucible. A few drops of diluted sulphuric acid may be added, and a slip of zinc foil introduced. Wherever the platina is touched by the zinc, metallic copper is deposited; and after having in this way coated the platina capsule, the surplus liquid may be poured off and the capsule well washed out. The copper is then dissolved in diluted nitric acid, and the tests may be applied after the excess of acid has been driven off by heat. This is perhaps the most expeditious and certain method of detecting a salt of copper in an organic liquid. It is, however, less delicate than the Iron-test.

Copper in articles of food.—The medico-legal history of poisoning by copper would be incomplete without some remarks on the action of certain articles of food on this metal when used for culinary purposes. This is not an unfrequent form of accidental poisoning. The symptoms rarely appear until after the lapse of three or four hours. There is commonly nausea, with colicky pains and cramps in the limbs. It results from the experiments of Falconer and others, that metallic copper undergoes no change by contact with *water*, unless air is present, when a hydrated carbonate, mixed with oxide of copper, is formed. If the water contain any acid, such as vinegar, or common salt, or if there be oily or fatty matter in contact with the metal, then the copper is more rapidly oxidized, and the liquor or fat acquires a green colour. If the copper vessel is kept perfectly clean, and the food prepared in it is allowed to cool in other vessels, there is not much risk of its acquiring a poisonous impregnation: nevertheless, no acid, saline, fatty, or oily liquid should be prepared as an article of food in a copper vessel. (See Ann. d'Hyg. 1832, vol. 1. p. 102.) Under the influence of heat and air, a portion of copper becomes dissolved, and the oily or other liquid acquires a green colour. The preparation of fruits, such as preserves, in copper vessels, is necessarily attended with some risk; for, on cooling, a green crust is apt to form on the copper, just above the surface where the air and acid liquid meet. Some liquids while boiling, appear to be but little liable to this impregnation:—thus, coffee, beer, milk and tea, have been separately boiled for two hours together, in a clean copper vessel, without any portion of the metal being taken up by either of the liquids. (See Falconer, on the Poison of Copper, 65, London, 1774, also Orfila, vol. 1. p. 611.) Accidents of this kind are usually prevented by lining the copper vessel with tin; but in very large boilers this plan is not always adopted—cleanliness alone is trusted to, and this, when properly observed, is a sufficient preventive. According to Paasch, of Berlin, many of the accidents attributed to this form of cupreous poisoning are really due to other causes. (Casper's Vierteljahrschrift, 1852, B. i. H. i. S. 78.) It has been elsewhere stated that all the ordinary copper employed for utensils contains arsenic (page 92). In those cases in which the metal is converted to insoluble oxides or salts, by salts, acids or fat, the arsenic may be found in an insoluble form in the green incrustation produced. When copper thus forms an insoluble salt I have not found any arsenic dissolved

It has been stated that an impure alloy used by some of the lower grade of dentists has been so largely composed of copper as to affect the health of those who have used the plates for the support of artificial teeth. The acid and salts in the saliva would facilitate the production of a poisonous salt of copper, and set free arsenic.

In the making of preserved *fruits* and vegetable *pickles*, the salts of copper (blue vitriol) are sometimes used for the purpose of giving a rich green colour. Many of the green pickles sold in shops are thus impregnated with the vegetable salts of this metal, to which they owe their bright grass-green colour. If the fruit or pickle is placed in a solution of ammonia, and copper is contained in it, the substance is speedily turned blue. The iron-test is, however, more delicate. A bright needle immersed in the pickle, or plunged into the solid, will be speedily coated with copper. The quantity of copper contained in such articles may not be sufficient to cause fatal effects; but serious symptoms of gastric irritation are sometimes produced, and in young persons these may assume an alarming character. (See Falconer, 87.)

CHAPTER 15.

TARTARIZED ANTIMONY—SYMPTOMS—FATAL DOSE—APPEARANCES—CHRONIC POISONING—CHEMICAL ANALYSIS—ANTIMONY IN ORGANIC LIQUIDS—CHLORIDE OF ANTIMONY—POISONING BY SULPHATE AND CHLORIDE OF ZINC—CARBONATE OF ZINC—PREPARATIONS OF TIN—SILVER—GOLD—IRON—BISMUTH AND CHROME—BICHROMATE OF POTASH.

Tartarized Antimony (Tartar Emetic), Stibiated Tartar.

Symptoms and effects.—When this substance is taken in a poisonous dose, a strong metallic taste is perceived in the mouth during the act of swallowing. There is great heat and constriction of the throat, with difficulty of swallowing, violent burning pain in the region of the stomach, followed by incessant vomiting, profuse purging, faintness, and extreme depression. The pulse is small and rapid, sometimes imperceptible; the skin cold, and covered with a clammy perspiration; and the respiration is painful. Should the case prove fatal, death may be preceded by giddiness, insensibility, great prostration of strength, and sometimes violent spasms of the muscles of the extremities, which may assume a clonic or a tetanic character. Such are the symptoms in an acute case of poisoning by this substance.

The *quantity* actually required to destroy life is unknown. It will probably depend in some degree on whether active vomiting and purging have been excited or not; for these symptoms have not been present in all cases. Doses of from twenty grains to one ounce have been taken without destroying life; although alarming symptoms of irritation have followed. In one case, related by Orfila, a man, aged fifty, took forty grains of tartarized antimony, and died in about four days. This was the only one out of five cases of poisoning by this substance quoted by Orfila which proved fatal. (Orfila, vol. 1. p. 480.) Dr. Beck mentions a case in which fifteen grains of tartarized antimony in solution killed a child in a few weeks: vomiting and purging ensued, followed by convulsions and death. This case proves that a patient is not always saved by vomiting and purging:—the fatal effects on such an occasion are probably due to rapid absorption. (See Medical Gazette, vol. 44. p. 334.) Dr. Pollock has recorded a case in which an adult was killed in ten hours by a dose of one drachm, in spite of early and violent vomiting. (Med. Gaz. vol. 45. p. 801.) In two cases observed by Mr. Hartley, which will be presently described, *ten grains* killed each child in a few hours. A dose of four grains, however, has been known to produce alarming symptoms. Dr. Lambert, who reports this case in Casper's Wochenschrift, states that this dose gave rise to violent pain in the abdomen, vomiting, and purging. The patient then fell into strong convulsions, which lasted half an hour. He became speechless,—no pulse could be perceived, the skin was cold, and it was supposed that he was dead. Stimulating frictions and poultices were employed, and he slowly recovered in about fourteen days. This poison might, in a much smaller dose, occasion death by reason of its exerting a depressing influence on the action of the heart. Aged persons, or those who are debilitated by disease, may die under these circumstances from a dose or doses which would produce no injury to strong and healthy adults. The effects, however, should be clearly traced to the action of the poison, and not be owing to exhaustion as a result of disease. In February, 1853, Mr. Wakley referred to me, for examination, a case in which it was supposed that two doses of antimonial wine, equal to about *three grains* of tartar emetic, had caused the death of a man who was in a diseased condition, by its remote effect upon the heart. No trace of poison was found in the stomach or tissues: there were no symptoms to indicate poisoning, and under these circumstances death could not be reasonably attributed to the medicine. The man died in about twenty hours afterwards, probably as a result of the exhaustion of the vital powers from disease, and not from the action of this substance.

In a case reported by Mr. Freer, of Stourbridge, a man, æt. twenty-eight, swallowed *two drachms* of tartarized antimony by mistake for Epsom salts, and recovered from its effects. An hour after the poison had been taken he was found in the following state:—his pulse imperceptible: tongue dry and red; countenance cold and livid, bathed with clammy perspiration, and indicative of great suffering; violent pain in the stomach and over the whole of the abdomen, with constant spasmodic contraction of all the muscles, particularly of the abdomen and upper extremities. The fingers were firmly contracted, and the muscles quite rigid. He vomited only once, about half an hour after he had swallowed the poison, and after this he had constant involuntary aqueous purging. An emetic of mustard and salt was given to him, and this produced violent vomiting of bilious matter. Green tea, brandy, and decoction of oak-bark were freely given. The cramps, vomitings, and aqueous purging continued for six hours. The symptoms then became mitigated, and he gradually recovered, suffering chiefly from profuse night perspirations. (Lancet, May 22nd, 1847, 535.) This case is remarkable for the anomalous character of the symptoms, as, in the absence of active vomiting, an emetic was actually required to be given,—also for the recovery of the individual after a large dose of the poison. In the Association Medical Journal for April 1, 1853, at page 281, will be found reported a case in which a physician took half an ounce of tartarized antimony by mistake for Rochelle salts. Vomiting did not come on for half an hour; but under good medical treatment he recovered in a few days. In another case fifty-five grains caused the death of an adult in sixteen hours. In one instance a small dose of this substance caused death by producing intestinal hæmorrhage. (See the same Journal, June 10, 1853, p. 513.) Mr. Procter, of York, communicated to me, in July 1860, the cases of four children to whom, by mistake, a mixture of sulphur and tartar emetic had been given. An ounce of sublimed sulphur and one drachm of tartarized antimony had been divided among the four. The symptoms presented the same characters in each;—early vomiting which became violent and incessant, pain in the bowels, purging, great thirst, cold clammy perspiration, feeble pulse, cramps of the limbs and twitchings of these parts, with great depression. There was no sense of heat or constriction in the throat, and no difficulty of swallowing. Under treatment they all recovered.

Appearances after death.—The following cases, reported by Mr. Hartley, show the nature of the appearances likely to be found after death:—Two children, a boy aged five years, and a girl aged three years, each swallowed a powder containing *ten grains* of tartarized antimony mixed with a little sugar. It was stated that, in twenty minutes after taking the powders, they were seized with violent vomiting and purging, and great prostration of strength, followed by convulsions and tetanic spasms: there was also great thirst. The boy died in eight hours, and the girl in twelve or thirteen hours after swallowing the dose. The bodies were inspected between four and five days after death. In that of the boy there was effusion of serum in the right pleura; the lower lobe of the right lung posteriorly was redder than natural, and the peritoneum was injected from recent inflammation. The mucous membrane of the duodenum was inflamed, and covered with a whitish-yellow viscid secretion; this was observed throughout the intestinal canal, although the colour was of a deeper yellow in the large intestines: there was no ulceration. The peritoneal coat of the stomach was inflamed. The mucous membrane of this organ was much inflamed, especially about the larger curvature and at the cardiac orifice: there was no ulceration. The contents (about two ounces and a half of a dark bloody fluid, having a slightly acid reaction) were adherent to it; and in one case there was a patch of lymph. The tests used did not indicate the presence of antimony. With regard to other appearances, the tongue was covered with a white fur, and appeared soddened; the throat was not inflamed; the wind-pipe and gullet had a natural appearance. On opening the head the dura mater was found vascular; the longitudinal sinus contained a coagulum of lymph, and but little blood. The vessels of the surface of the brain were much injected with dark blood, the whole surface having a deep purple colour. Every portion of the brain, when cut, presented many bloody points. The cerebellum and medulla oblongata were also extremely vascular; there was no effusion in the ventricles or at the base of the brain. In the body of the girl the morbid appearances were similar: there were also patches, resembling the eruption of scarlatina, on the arms, legs, and neck. The arachnoid membrane was more opaque than usual; and on the mucous membrane of the stomach, where the inflammation was greatest, were two or three white spots, each about the size of a split pea, which appeared to be the commencement of ulceration. (Lancet, April 25, 1846, 460.) A girl, æt. sixteen, swallowed a dose of tartarized antimony amounting to from forty to sixty grains. There was severe vomiting in a quarter of an hour, and this was soon followed by purging: these symptoms continued for about three hours. She also complained of pain, and a burning sensation down the gullet. The vomited matters were of a dark colour. On the following morning she had recovered from the severity of the symptoms: but in the afternoon there was a relapse. She continually threw her head back and screamed; the skin was warm and moist; the pupils were dilated; and the knees drawn up. She died in about thirty-six hours after taking the poison, and during the six or eight hours previous to her death she was quite delirious. An inspection was made thirty-six hours after death. The throat appeared swollen; the lungs were slightly congested; the heart was healthy, and contained about six drachms of fluid blood.

The stomach contained sixteen ounces of a thick bloody fluid: at the greater extremity the coats were softened, and blood was effused under the mucous coat in several places. The small intestines contained a similar fluid, with much mucus; but there was no appearance of inflammation. Only slight traces of the poison were found in the contents of the stomach by the usual tests, the greater part having probably passed off by vomiting and purging. (Mr. Beale, in Lancet, Jan. 21, 1854.) In animals poisoned by this substance it is common to find general inflammation of the alimentary canal.

It has been hitherto supposed that the cases in which this poison has proved fatal have been few; but I have elsewhere reported thirty-seven, of which sixteen were fatal. The smallest fatal dose was in a child,—*three quarters of a grain*, and in an adult, two grains; but in this case there were circumstances which favoured the fatal operation of the poison. (Guy's Hospital Reports, Oct. 1857.)

Chronic poisoning.—A good account of the effects produced by this poison, given at intervals in small doses to healthy persons, has been published by Dr. Mayerhofer (Heller's Archiv., 1846, pts. 2, 3, 4, page 100, *et seq.*). The principal symptoms are,—great nausea, vomiting of mucous and bilious liquids, great depression, watery purging, followed often by constipation of the bowels,—small, contracted, and frequent pulse,—loss of voice and muscular strength,—coldness of the skin, with clammy perspiration, and death from complete exhaustion. Several cases have recently occurred in this country, which show that tartarized antimony has been thus criminally used. In addition to the cases of *Ann Palmer* and *J. P. Cook*, there are those of *Reg.* v. *M'Mullen*, Liverpool Summer Assizes, 1856; *Reg.* v. *Freeman*, Drogheda Spring Assizes, 1857; and the cases of the *James family* at Liverpool (*Reg.* v. *Winslow*, Liverpool Autumn Assizes, 1860). The prisoner *Winslow* was indicted for the murder of his mistress, Ann James. It was clearly proved that antimony had been administered to the deceased, not only by the careful discrimination of the symptoms made by Dr. Cameron, but by the detection of the poison in the urine during life by Dr. Edwards. The deceased was at the time labouring under malignant disease affecting the cæcum and stomach, but that her death had been accelerated by antimony there could be no doubt. The prisoner was acquitted owing to the difficulty of proving the act of administration. The poison had been given at intervals in small doses, and as deceased survived about a fortnight after the last dose, it was only found in traces in the various organs. The death of this woman led to the exhumation of the bodies of three of her relatives who had lived in the same house with her and the prisoner, and had died suddenly some months previously under suspicious circumstances.

The viscera of these bodies were examined by Dr. Edwards, Dr. Miller, and myself, and in each case antimony was found in small quantity but still extensively diffused through the organs. There was no reason to suppose that they had taken this antimony voluntarily, and there is no reason to doubt, so far as the history of their cases could be obtained, that they were victims to chronic poisoning by antimony. This was the only cause of death, but it was not suspected at the time. (See ante, p. 22; Guy's Hospital Reports, October, 1857, and October, 1860; also *Reg.* v. *Hardman*, Lancaster Summer Assizes, 1857.)

Chemical analysis. Tartarized antimony as a solid.—In the state of powder it is white and crystalline. It has been occasionally sold by mistake for tartaric acid with soda powders, and sometimes for cream of tartar.—1. It is easily dissolved by water,—it is taken up by fourteen parts of cold, and two of boiling water; the solution has a faint acid reaction, and an acrid caustic taste; it is decomposed by long keeping. It is insoluble in alcohol. 2. The powder dropped into hydrosulphuret of ammonia is turned of a deep reddish-brown colour, and is thereby known from other poisonous metallic salts. 3. When heated in a reduction-tube, it is charred, but does not melt before charring, like the acetate of lead. The metal is partially reduced by the carbon of the vegetable acid, and the decomposed mass has a greyish-blue metallic lustre. I have not found that a metallic sublimate is produced in this experiment by the heat of a spirit-lamp. 4. When boiled with pure hydrochloric acid and metallic copper, a grey deposit of antimony takes place on that metal. The colour of the deposit is violet red if the quantity be very small, and the deposit is black and pulverulent if very large.

Tartarized antimony in solution.—1. On slowly evaporating a small quantity on a slip of glass, it will crystallize in *tetrahedra*. If obtained from a very diluted solution, this crystallization is confused, and resembles that of arsenic. 2. *Diluted nitric acid* added to the solution, throws down a white precipitate (subnitrate of antimony): the other two mineral acids act in the same way; but, as they precipitate numerous other metallic solutions, there are objections to them which do not hold with respect to nitric acid. The white precipitate thus formed possesses the remarkable property of being easily and entirely dissolved by a solution of tartaric acid:—it is also soluble in a large excess of nitric acid, so that if much of the test be added at once, no precipitate is produced. 3. *Ferrocyanide of potassium* does not precipitate the solution, whereby tartarized antimony is known from most other metallic poisons. 4. *Hydrosulphuret of ammonia* or *sulphuretted hydrogen gas*, produces in the solution a reddish orange-coloured precipitate, differing in colour from every other metallic sulphuret. The precipitate is not soluble in ammonia, but is dissolved in the dry state by strong hydrochloric acid. The only test available when the quantity of tartarized antimony present is small, is sulphuretted hydrogen gas.

The foregoing tests, it will be observed, merely indicate the presence of oxide of antimony,—but this is in reality the poison which we have to seek,—the cream of tartar with which it is combined being merely the vehicle; and in a case of poisoning, this is no more the object of medico-legal research than if it were the vehicle for the administration of arsenic or corrosive sublimate. It is, besides, well known that tartarized antimony is the only salt of the oxide of antimony in a soluble form which is likely to be met with in medicine or chemistry. Should it be required to prove the presence of cream of tartar, this may be done by filtering the liquid from which the oxide of antimony has been entirely precipitated by sulphuretted hydrogen gas. On evaporating this liquid, the cream of tartar may be obtained.

In liquids containing organic matter.—Tartarized antimony is precipitated by tannic acid in all its forms, but not readily by albumen or mucous membrane; therefore it may be found partly dissolved in the liquids of the stomach, provided no antidote has been administered. The liquid must be filtered, and then strongly acidulated with tartaric acid. A current of sulphuretted hydrogen gas is now passed into it, until there is no further precipitation. The sulphuret is collected, washed, and dried. If it is the sulphuret of antimony, it will have an orange-red or brown colour, it will be insoluble in a solution of ammonia, and when dried, will be dissolved by a small quantity of boiling hydrochloric acid (forming chloride of antimony) with the evolution of sulphuretted hydrogen gas. The boiling should be continued for several minutes until the liquid is colourless. On adding this solution, if not too acid, to a large quantity of water, a dense white precipitate of oxychloride of antimony (powder of Algaroth or Algarotti, *Mercurius Vitæ*) falls down. This is characteristic of antimony. If it be objected that nitrate of *bismuth* undergoes a similar change when dropped into water, hydrosulphuret of ammonia will easily enable us to distinguish the two metals; the antimonial precipitate is turned of an orange-red by that solution, while the bismuthic precipitate is turned of a deep black. There are other methods of identifying the precipitated sulphuret of antimony. The dry sulphuret placed in a hard glass tube through which a current of hydrogen is passing, and intensely heated, is converted to iron-grey metallic antimony, and sulphuretted hydrogen escapes. The best method of identification is to dissolve in pure hydrochloric acid, and introduce the solution with pure zinc into a Marsh's tube or flask, similar to that described under arsenic (page 87). The antimoniuretted hydrogen produced may be dried by chloride of calcium, and the tube through which it is passing heated to redness:—metallic antimony is deposited. This is dissolved by nitric acid, and on evaporation leaves a white insoluble residue of peroxide of antimony, on which a solution of nitrate of silver has no effect. The gas may be at once passed into a strong nitric acid: in this case the peroxide of antimony is obtained on evaporation of the acid. A medical jurist must remember that the discovery of tartarized antimony in the contents of a stomach is by no means a proof of its having been taken or administered as a poison; since it is frequently prescribed as a medicine, and often taken as such by persons of their own accord. We could only suspect that it existed as a poison, or had caused death, when the quantity present was large, and there were corresponding appearances of irritation in the alimentary canal. The presence of any quantity, if not lawfully administered as a medicine, is always a suspicious fact, and demands explanation. In two cases of criminal administration in small doses, the quantity found in each body did not exceed three grains. The discovery of it in a medicinal mixture would not of itself be evidence of an intent to poison.

In the tissues.—For the detection in, and the separation of antimony from, the *tissues*, the best plan, according to my experiments, is that which was originally suggested by Reinsch, in 1841. The antimonial compounds, when distilled with hydrochloric acid, do not readily pass over into the receiver. They are much more fixed than those of arsenic. In the examination of the tissues of persons poisoned by antimony, I have not been able to procure, by distillation with hydrochloric acid, any trace of the metal in the distillate, although antimony was readily found by Reinsch's process in the residue in the retort. If this fact should be corroborated by future inquirers, the distillation-process will furnish an easy method of separating absorbed arsenic from absorbed antimony. In reference to the distillation of tartarized antimony with hydrochloric acid, I have found that, contrary to what might be expected, the metal passes over more readily into the distillate when the acid is mixed with water than when it is concentrated: but even in this case the quantity thus obtained by distillation is small. It is the reverse with arsenic. (See page 98. Also Guy's Hosp. Reports, Oct. 1860, p. 263.)

The method of proceeding for antimony is as follows:—1. Boil the viscera, in a finely-divided state, in one part of pure hydrochloric acid, and from four to six parts of water. Boil in a flask or retort, and condense by a funnel the acid vapour as it issues. Introduce slips of polished copper-foil (free from antimony). Continue the boiling for at least two hours before concluding on a negative result. In certain cases it may be necessary to employ from twelve to sixteen ounces of organic matter, and a proportionate quantity of acid and water, in one operation. 2. Wash in water the pieces of copper when coated, and observe the violet red or steel grey film, according to the thickness of the metallic deposit. The deposit of antimony obtained from a very diluted solution has a reddish or violet tint: and Reinsch considered this colour to be a sufficient distinction from the deposit of arsenic on copper. In addition to the colour, it may be noticed, that while the arsenical deposit is sublimed at a low heat (400°) in a crust of octahedral crystals, the antimonial deposit is much more fixed, and when heated to a very high temperature yields only a white amorphous film of oxide of antimony. This can, however, rarely be obtained in sufficient quantity to be dissolved by a solution of tartaric acid (free from lead), and precipitated by a current of sulphuretted hydrogen gas. We may, however, identify the deposit of antimony by the following process:—3. Boil as many of the coated pieces of copper as can be collected, in a solution of *pure* potash (proved to be entirely free from lead), in a test-tube, occasionally exposing the coated surfaces of metal to the air. The antimony is oxidized and dissolved by the potash. 4. Filter the potash-solution; acidulate with pure hydrochloric acid, and pass into the liquid a current of sulphuretted hydrogen gas. An orange-red sulphuret of antimony is precipitated. If small in quantity, this may appear at first of a pale yellow colour, but as it subsides it becomes of an orange-red. The sulphuret may now be treated with ammonia and hydrochloric acid, and tested by Marsh's process in the manner described at page 154.

This process is sufficiently delicate for all practical purposes. As a proof of this, I may mention that it enabled Dr. Miller, Dr. Edwards, of Liverpool, and myself, to procure good evidence of antimony in a liver containing not more than 1-160th of a grain in two ounces of its substance. We also employed the process successfully for the detection of free and absorbed antimony, when existing in very small quantity in sixteen separate analyses of the viscera. Three of the bodies, from which the viscera were taken, had been buried from a period of from six to nine months. It is preferable to the method of carbonization whether with or without the use of sulphuric acid. Chlorate of potash may be occasionally employed for the destruction of organic matter as described under arsenic (ante, p. 95; Ann. d'Hyg., 1859, vol. 1. p. 192). Dr. Odling has recommended the oxidation of the antimonial deposit on copper by permanganate of potash alkalized with pure potash. The result is more rapidly obtained, and is indicated by the loss of colour in the permanganate. As nearly all the solutions of potash contain oxide of lead, this metal must be precipitated by sulphuretted hydrogen, and separated by filtration either before the alkaline liquid is used, or after boiling the coated copper in the alkali, and before the addition of hydrochloric acid. Hydrochloric acid sometimes contains antimony as an impurity.

The separation of antimony from the tissues does not necessarily indicate that it has been criminally administered or has caused death; but its presence should be reasonably accounted for, as antimony may have been unlawfully administered. In several cases of suspected death from poison, deposits on copper, evidently of an antimonial nature, have been obtained from the liver or tissues. On inquiry it has been found that antimonial medicines had been taken shortly before death. Conversely, when no antimony is found, or the mineral is present in the tissues in minute quantity, it is still consistent with medical experience and observation that the person may have died from antimony. The case of *Mrs. Peters*, of Yeovil, (July, 1860), furnishes a recent and remarkable illustration of this fact. (See page 23.) This lady had symptoms during her illness which were referred by her medical attendants to the effects of small doses of antimony. Antimony was found in the urine both by them as well as by Mr. Herapath: but after the death of this lady (*i. e.* in about nine days) no antimony was found in the body. Upon this fact and the evidence of coexisting disease, it was alleged that she had died from disease and not from poison. The jury returned a verdict to the effect that her death had been accelerated by irritant poison. (Med. Times and Gazette, Aug. 25, 1860, p. 190: Sept. 15, p. 271; and Sept. 29, p. 317.) Assuming the results of the analysis of the urine during life to be correct, there can be no question that antimony was administered to her: and the statement of the acceleration of death is rendered probable. The case is important in this respect: it shows that antimony may be found in an evacuation and that death may be accelerated by it: but although the person may die within nine days, none will be found in the body. The medical and chemical evidence given in this case furnishes a curious commentary on the evidence given for the defence of *William Palmer* for the murder of John Parsons Cook.

Chloride of Antimony. Sesquichloride or Butter of Antimony.

Symptoms and appearances.—A boy, aged twelve, swallowed by mistake for ginger beer four or five drachms of a solution of butter of antimony. In half an hour he was seized with vomiting, which continued at intervals for two hours. There was faintness, with general weakness, and great prostration of strength. Remedial means were adopted, and the next day the chief symptoms were heat and uneasiness in the mouth and throat, with pain in swallowing. There were numerous abrasions on the mucous membrane of the mouth and throat; and there was slight fever, from which the boy quite recovered in about eight days. Another case of recovery from a dose of an ounce is reported in the Lancet, Feb. 26, 1848, p. 230. I am indebted for the following case to Mr. Mann. An army surgeon swallowed, for the purpose of suicide, from two to three ounces by measure of chloride of antimony. About an hour afterwards he was seen by Mr. Mann. There was entire prostration of strength, with coldness of skin, and incessant attempts to vomit. The most excruciating griping pains were felt in the abdomen; and there was a frequent desire to evacuate the bowels, but nothing was passed. In the course of a few hours reaction took place, the pain subsided, and the pulse rose to 120. There was now a strong disposition to sleep, so that he appeared as if labouring under the effects of a narcotic poison. In this state he continued until he died,—ten hours and a half after he had swallowed the poison. On inspection the interior of the alimentary canal from the mouth downwards to the jejunum, presented a black appearance, as if the parts had been charred. In general, there was no mucous membrane remaining, either on the stomach or elsewhere; only a flocculent substance, which could be easily scraped off with the back of the scalpel, leaving the submucous tissue and the peritoneal coat. All these parts were so soft that they were easily torn by the fingers.

Analysis.—If any portion of the chloride be left in the vessel, it may be tested by adding a few drops to a large quantity of water, when the whitish-yellow oxychloride of antimony will be precipitated: the supernatant liquid will contain hydrochloric acid, which may be detected by nitrate of silver. It has been already observed, that the only objection to this mode of testing is, that the salts of *bismuth* are also decomposed by water; but the precipitate in this case is insoluble in tartaric acid, and is blackened by hydrosulphuret of ammonia; while in the case of antimony it is soluble in that acid, and is changed to an orange-red colour by the hydrosulphuret. As all the commercial chloride contains iron, the colour given by this test may be greenish-black.

PREPARATIONS OF ZINC. SULPHATE OF ZINC. WHITE VITRIOL OR WHITE COPPERAS.

Symptoms and appearances.—The symptoms produced by an over-dose of sulphate of zinc are pain in the abdomen and violent vomiting, coming on almost immediately, followed by purging. After death the stomach has been found inflamed. The sulphate appears to act as a pure irritant; it has no corrosive properties. This salt may cause death indirectly as the result of exhaustion from violent vomiting, when an ordinary dose has been given to a person already debilitated by disease. (Med. Times and Gaz., July 16, 1853, p. 78.) Dr. Gibb has reported a case of poisoning by this substance, in which a lady recovered after taking sixty-seven grains. (Lancet, May 17, 1856.) A case is reported by Dr. Ogle, in which it is supposed that this substance destroyed life by its slow or chronic effects. (Lancet, Aug. 27, 1859, p. 210.)

Analysis.—The pure sulphate is seen in white prismatic crystals, closely resembling in appearance sulphate of magnesia and oxalic acid; from oxalic acid it is distinguished by remaining fixed when heated on platina foil,—from the sulphate of magnesia, by tests applied to its solution. It is readily dissolved by water, this fluid taking up about one-third of its weight at common temperatures. Analysis of the *solution.*—The solution has a slightly acid reaction. The following tests may be used for the detection of oxide of zinc. 1. *Ammonia* gives a white precipitate, soluble in an excess of the alkali. 2. *Sesquicarbonate of ammonia*, a white precipitate, also soluble in a large excess of the test. 3. *Ferrocyanide of potassium*, a white precipitate. 4. *Sulphuretted hydrogen* and hydrosulphuret of ammonia, a milky-white precipitate, provided the solution is *pure* and neutral, or nearly so. If the solution is very acid, sulphuretted hydrogen produces no effect whatever.

In organic mixtures.—If the sulphate of zinc is dissolved and the solution is not too acid, we may pass into it a current of sulphuretted hydrogen gas: the presence of zinc is immediately indicated by a milky-white froth—the sulphuret may be collected, and decomposed by boiling it with hydrochloric acid. The solution may be then tested for zinc. This compound being frequently employed as an emetic, may be innocently present in an organic liquid, or in the contents of the stomach.

Chloride of Zinc.

The Chloride of zinc is sold to the public as a disinfectant, under the name of "Sir W. Burnett's Fluid." This is a highly concentrated solution of the pure, or sometimes impure, chloride of the metal; it has been taken by accident in several cases, and in one instance was supposed to have been criminally administered as a poison.

Symptoms.—In a case reported by Dr. Stratton, about two ounces of a solution containing only twelve grains of the chloride were swallowed. The patient immediately felt pain and nausea; vomiting followed, and she recovered, but suffered from some indisposition for three weeks. In a second case, a wineglassful, equivalent to at least two hundred grains of solid chloride, was swallowed. The man instantly experienced burning pain in the gullet, burning and griping pain in the stomach, great nausea, and coldness. Vomiting came on in two minutes; the legs were drawn up to the body; there was cold perspiration, with other signs of collapse. The man perfectly recovered in sixteen days. (Ed. Med. and Surg. Journal, Oct., 1848, p. 335; and British American Journal, Dec., 1848, p. 201.) Other cases show that the concentrated liquid has a strong corrosive action locally, destroying the membrane of the mouth, throat, gullet, and stomach. There has been frothing of the mouth, with general lividity, and coldness of the skin. In a case in which only a mouthful of the fluid had been swallowed, the patient experienced giddiness and loss of sight, with immediate burning heat in the stomach: vomiting and purging came on, and the former symptom continued for a week. There was so much irritability of the stomach for a period of three weeks, that the patient became greatly reduced. Among the early symptoms was loss of voice, which did not return for five weeks. (Med. Times, Oct. 11, 1851, p. 382; and Nov. 8, 1851, p. 497.) Dr. R. Hassall has reported a case in which the nervous symptoms were strongly marked, and were of a peculiar kind. Three ounces of "Burnett's Fluid" were swallowed. There was immediately a sense of constriction in the throat, with a hot burning sensation in the stomach. There was no pain in the mouth, and there was no appearance of corrosion in this cavity or on the lips. There was incessant vomiting, the vomited matters consisting of thick mucus, streaked with blood, and some portion of mucous membrane was discharged. There was no purging until the third day, when the discharges from the bowels had a coffee-ground appearance. After the lapse of a fortnight a train of nervous symptoms set in, indicated by a complete perversion of taste and smell. The patient recovered in about three months. (Lancet, Aug. 20, 1853, p. 159.) A case which occurred to Dr. Markham proved fatal in about *ten weeks* after the poison had been swallowed. The patient, a woman, æt. forty-six, took half a wine-glassful of Burnett's liquid, equal to about one hundred grains of chloride of zinc. Immediately after taking it she suffered from vomiting and pain in the stomach. She drank freely of water: the vomiting ceased in a few days, and she appeared to have recovered. In about three weeks the vomiting returned: it was incessant, and with this there was pain in the stomach. She sank exhausted, evidently from the secondary effects of the poison. (Medical Times and Gazette, June 11, 1859, p. 595.)

Appearances after death.—In the case of an infant, aged fifteen months, who died from the effects of this poison, the lining membrane of the mouth and throat was white and opake. The stomach was hard and leathery, containing a liquid like curds and whey. Its inner surface was corrugated, opaque, and tinged of a dark leaden hue. The lungs and kidneys were congested. The fluid of the stomach was found to contain chloride of zinc. (Med. Times, July 13, 1850, p. 47.) These facts show that the concentrated solution of chloride of zinc is both a corrosive and an irritant poison, exerting also occasionally an action on the nervous system. In a case which proved fatal at Guy's Hospital, in 1856, the coats of the stomach were excessively thickened, and had a leathery consistency. In Dr. Markham's case, the stomach was so constricted at the pyloric end by a cicatrix that it would only admit a crow-quill. The pyloric opening was involved in this cicatrix, which was about one quarter of an inch wide. There was no other sign of disease in the body. This case proves that death may occur from this poison even after apparent recovery. The chloride of zinc may destroy life either by producing stricture of the gullet or pylorus, or by its chemical action on the lining membrane of the stomach leading to a loss of power of digestion, to emaciation, and exhaustion.

Analysis.—The chlorine may be detected by nitrate of silver—the zinc by the tests above described. (See Sulphate.) All the samples which I have examined contained iron.

Zinc can be detected in the *tissues* only by incineration and an examination of the ash. The chloride is, however, sometimes used for the preservation of the dead body. This might account for its presence.

CARBONATE OF ZINC (CALAMINE).

This compound does not appear to have any poisonous action: and it would probably require to be given in large quantity to produce any effect. Carbonate of zinc is the white substance which is formed on the metal when long exposed to air and moisture. Its effects may become a subject of investigation as a matter of medical police, since zinc is now much used for roofing, and also in the manufacture of water-pipes and cisterns. (See Ann. d'Hyg. 1837, 281, vol. 2, p. 352; also Edinburgh Monthly Journal, Aug. 1850, p. 181.)

PREPARATIONS OF TIN.

The only preparations of this metal which require to be noticed as poisons are the *Chlorides*, or *Muriates*, a mixture of which is extensively used in the arts, under the name of *Dyer's Spirit*. The salts may exist in the form of whitish-yellow crystals: but more commonly they are met with in a strongly acid solution in water. They are irritant poisons; but so seldom used as such, that only one death occurred from them in England and Wales during a period of two years.

PREPARATIONS OF SILVER.

Nitrate of Silver. Lunar Caustic. Lapis Infernalis.—This substance, which is commonly met with in small sticks of a white or dark-grey colour, is readily soluble in distilled water; in common water it forms a milky solution. It acts as a powerful corrosive, destroying all the organic tissues with which it comes in contact. There are at least two cases on record in which it has proved fatal in the human subject: one of these occurred in 1837-8, but the particulars are unknown. The symptoms come on immediately, and the whitish flaky matter vomited is rendered dark by exposure to light. Dark-coloured spots on the exposed parts of the skin will also indicate the nature of the poison.

PREPARATIONS OF GOLD.

Perchloride.—This is the only preparation of gold which requires notice. It is a powerful irritant poison, acting locally like the nitrate of silver. Nothing is known of its poisonous effects on man; but, in administering it to animals, Orfila has found that it caused extensive inflammation, and even ulceration, of the mucous membrane of the stomach. (Toxicologie, vol. 2. p. 30.) The metal is absorbed and carried into the tissues, but its poisonous action appears to be wholly independent of absorption.

PREPARATIONS OF IRON.

Sulphate of Iron. Copperas. Green Vitriol.—This compound has been several times administered with malicious intention. One death from it took place in 1837-8. It cannot, however, be an active preparation; for a girl who swallowed an ounce of it recovered, although she suffered for some hours from violent pain, vomiting, and purging. (Christison on Poisons, p. 506.) Green vitriol or copperas is sometimes given as an abortive. A suspicious case is reported, in which a woman far advanced in pregnancy, but enjoying good health, was suddenly seized about midnight with vomiting and purging, and died in about fourteen hours. The body, which had been buried, was disinterred, and iron found in large quantity in the viscera. The symptoms are not always of this violent kind. In a case which occurred to M. Chevalier, a man gave a large dose of sulphate of iron to his wife. There was neither colic nor vomiting. The woman lost her appetite, but ultimately recovered. In another case reported by the same authority, a woman was tried and convicted of poisoning her husband with sulphate of iron: but in consequence of the great diversity of opinion among the scientific witnesses at the trial respecting the poisonous properties of this metallic salt, and the dose in which it would be likely to operate injuriously, the Court and Jury recommended that the sentence of death should not be carried into execution. (Ann. d'Hyg. 1851, vol. 1. p. 155.) The reader will find some remarks in reference to the action of the sulphate of iron on the body, by the late M. Orfila, in the same Journal, 1851, vol. 2. p. 337. At the Nottingham Autumn Assizes, 1859, a woman of the name of *Riley* was indicted for administering copperas to two children. She put the substance into gruel. It gave to the gruel a greenish colour and a peculiar taste, which led to the discovery. It caused sickness, but no other serious symptoms. As there was no evidence of an intent to murder, and it was then lawful to administer poison with any other intent, the prisoner was acquitted. This omission of the law regarding the administering of poison has been supplied by the recent Act 23 Vict. chapter 8, 1860. (See page 4.)

Muriate of iron. Tincture of sesquichloride of iron.—This is an acid solution of perchloride of iron with alcohol, of a red colour, much used in medicine. Dr. Christison relates an instance in which a man by mistake swallowed an ounce and a half of this liquid: the symptoms were somewhat like those produced by hydrochloric acid. He at first rallied, but died in about five weeks. The stomach was found partially inflamed, and thickened towards the lesser end (the pylorus). This salt has been much used for criminal purposes in France. (See Medical Gazette, vol. 47. p. 307: also Ann. d'Hyg. 1850, vol. 1. p. 180, 416; and 1851, vol. 1. p. 155, vol. 2. p. 337.) A case was reported to the Westminster Medical Society, in November, 1842, in which a girl, aged fifteen, five months advanced in pregnancy, swallowed an ounce of the tincture of muriate of iron in four doses in one day, for the purpose of inducing abortion. Great irritation of the whole urinary system followed; but this was speedily removed, and she recovered. Another case of recovery from a large dose of this preparation has been reported by Mr. Amyot. A healthy married female swallowed, by mistake for an aperient draught, *one ounce and a half* of the tincture of muriate of iron. She immediately ejected a portion, and violent retching continued for some time. There was great swelling of the glottis, with cough, and difficulty of swallowing. These symptoms were followed by heat and dryness of the throat, with a pricking sensation along the course of the gullet and stomach; and in the afternoon a quantity of dark liquid blood was vomited. The motions were black, owing doubtless to the action of sulphur upon the metal. In about a month the patient was perfectly restored to health. (Provincial Journal, April 7 and 21, 1847. p. 180.) Another case of recovery from a large dose has been reported by Sir James Murray. The patient, æt. seventy-two, swallowed by mistake *three ounces* of the tincture in a concentrated state. The tongue soon became swollen; a ropy mucus flowed from the mouth and nose; there was croupy respiration, with a sense of impending suffocation. The pulse was feeble, the skin cold and clammy, and the face swollen and livid. A castor-oil mixture brought away inky evacuations, and the patient rapidly recovered. (Dub. Med. Press, Feb. 21, 1849.) This liquid has been used in large doses for the purpose of criminal abortion.

Chemical Analysis.—The hydrochloric acid may be detected by nitrate of silver and nitric acid, while the peroxide of iron is immediately indicated by a precipitate of Prussian blue on adding a solution of *Ferrocyanide of potassium.*

PREPARATIONS OF BISMUTH.

Subnitrate of Bismuth. Pearl-white. Magistery of Bismuth.—This substance, in a dose of *two drachms*, caused the death of an adult in nine days. There was a strong metallic taste in the mouth, burning pain in the throat, with vomiting and purging, coldness of the surface, and spasms of the arms and legs. On inspection, the throat, windpipe, and gullet were found inflamed; and there was inflammatory redness in the stomach and throughout the intestinal canal. (Sobernheim, p. 335.) In a case mentioned by Dr. Traill, a man took by mistake *six drachms* of the subnitrate, in divided doses, in three days. He suffered from vomiting and pain in the abdomen and throat, but finally recovered. (Outlines, p. 115.) These cases are sufficient to prove that a substance very slightly soluble in water may exert a powerfully poisonous action on the human system. The oxide and subnitrate of bismuth are frequently contaminated with arsenic in the form of arsenic acid.

The symptoms produced by large doses have closely resembled those caused by arsenic, and as the medicinal subnitrate generally contains arsenic, the symptoms may have been due to this impurity. I found arsenic in comparatively large proportion in samples obtained from three respectable retail druggists. Only two specimens out of five were found free from arsenic. The poison may be detected by dissolving the subnitrate in pure hydrochloric acid slightly diluted, and introducing it into Marsh's apparatus. The arsenical flame is apparent on combustion, and the usual deposits may be obtained on glass and porcelain. On collecting the products of combustion in a saucer wetted with ammonio-nitrate of silver the yellow arsenite of silver is produced. This fact may modify a conclusion respecting the presence of traces of arsenic in a body when bismuth has been administered medicinally. (See Brit. and For. Med. Chir. Rev. Oct. 1858.)

Analysis.—The subnitrate is a whitish chalky-looking uncrystalline powder insoluble in water, dissolved by hydrochloric acid, and again precipitated white by dilution with water:— this white precipitate is blackened by a solution of sulphuretted hydrogen, or by hydrosulpuret of ammonia.

Preparations of Chromium.

Bichromate of Potash.—Well-observed instances of poisoning by this compound, which is now extensively used in the arts, are rare; and therefore, the details of the following case, communicated to the Medical Gazette (vol. 33. p. 734) by Mr. Wilson of Leeds, are of practical interest. A man, aged sixty-four, was found dead in his bed twelve hours after he had gone to rest: he had been heard to snore loudly during the night, but this had occasioned no alarm to his relatives. When discovered he was lying on his left side, his lower limbs being a little drawn up to his body: his countenance was pale, placid, and composed; eyes and mouth closed; pupils dilated; no discharge from any of the outlets of the body; no marks of vomiting or purging, nor any stain upon his hands or person, or upon the bed linen or furniture. The surface was moderately warm. Some dye-stuff, in the form of a black powder, was found in his pocket. On inspection, the brain and its membranes were healthy and natural; there was neither congestion nor effusion in any part. The thoracic viscera were equally healthy, as well as those of the abdomen, with the exception of the liver, which contained several hydatids. A pint of a turbid inky-looking fluid was found in the stomach. The mucous membrane was red and vascular, particularly at the union of the greater end with the gullet: this was ascribed to the known intemperate habits of the deceased. In the absence of any obvious cause for death, poison was suspected: and on analyzing the contents of the stomach they were found to contain bichromate of potash. The dye-powder taken from the man's pocket consisted of this salt mixed with cream of tartar and sand. It is remarkable that in this case there was neither vomiting nor purging. The salt does not appear to have operated so much by its irritant properties as by its indirect effects on the nervous system. This, however, is by no means an unusual occurrence, even with irritants far more powerful than the bichromate of potash. A case has been communicated to me by Mr. Bishop, of Kirkstall, in which a boy recovered from the effects of a dose of this salt only after the lapse of four months. The first symptoms were pain, vomiting, dilated and fixed pupils, cramps in the legs, and insensibility. His recovery was due to early and active treatment. A report of this case will be found in Guy's Hosp. Reports, Oct. 1850, p. 214.

There can be no doubt that bichromate of potash is an active poison. Mr. West has published a case from which it appears that a medical man, who had inadvertently tasted a solution of it, suffered from severe symptoms resembling those of Asiatic cholera. (Provincial Journal, Dec. 24. 1851, p. 700.) Mr. Wood of St. Bartholomew's Hospital has furnished me with the particulars of a case in which two drachms of this substance destroyed the life of a woman in *four hours*. In the first two hours she suffered from violent vomiting and purging, the vomited matters being of a yellow colour. When admitted she was in a dying state, pulseless, unconscious, and breathing slowly, and with great effort. The skin was cold; the lower lip swollen and purple, and the tongue swollen. The chief appearances were,—a dark and liquid state of the blood; the mucous membrane of the stomach in great part destroyed, of a dark brown colour approaching to purple; the duodenum at its upper part was of a florid red colour, at its lower part it was much corrugated, as well as the upper half of the jejunum.

VEGETABLE AND ANIMAL IRRITANTS.

CHAPTER 16.

MODE OF ACTION OF VEGETABLE IRRITANTS. ALOES. COLOCYNTH. GAMBOGE. JALAP. SCAMMONY. SAVIN. CROTON OIL. CASTOR SEEDS. COLCHICUM. HELLEBORE. OIL OF TURPENTINE. OIL OF TAR. MOULDY BREAD. ERGOT OF RYE. CAROB OR LOCUST BEAN.

General Remarks.—The poisonous substances of an irritant nature which belong to the vegetable kingdom are very numerous as a class; but it will here be necessary to notice only those which have either caused death, or have given rise to accidental poisoning.

ALOES. COLOCYNTH. GAMBOGE. JALAP. SCAMMONY.

These different substances, which are used in small doses as medicines, are liable, when taken in large quantities, to excite vomiting, purging, and other symptoms of irritation. Colocynth has occasioned death in several instances: in one case a teaspoonful and a half of colocynth powder destroyed life: and one drachm of gamboge, a medicine much used by quacks, has proved fatal to man. (Traill's Outlines, 150.) Aloes and colocynth mixed are said to be the basis of a certain quack medicine sold under the name of Morison's Pills. These have proved fatal in many instances from the exhaustion produced by excessive purging, owing to the large quantity of these pills taken in frequently repeated doses. Our knowledge of the symptoms and appearances produced by these irritants is, indeed, chiefly derived from the cases which have proved fatal under this pernicious treatment. In the seventeenth volume of the Medical Gazette will be found four cases of this description. The most prominent symptom is excessive purging, with the discharge of large quantities of mucus; the individual becomes emaciated, and slowly sinks. In some instances the symptoms are those of inflammation and ulceration of the bowels. In 1836, a man was convicted of having caused the death of a person by the administration of these pills; in this instance the death of the deceased was clearly due to the medicine; and on inspection the stomach was found inflamed and ulcerated; the mucous membrane of the small intestines was inflamed and softened, and there was the appearance of effused lymph upon it. An ingenious attempt was made in the defence to draw from the medical witness a statement that the good effects of some medicines invariably increased in proportion to the quantity taken. This was, however, very properly denied. The same remarks apply to Holloway's pills, although these are of a more innocent description. The principal ingredient in them is aloes. In all cases it must be remembered that these drastic purgatives may cause serious symptoms, or even death, when administered to infants, or to persons debilitated by age or disease; and it is not necessary that the dose should be very large in order that fatal effects should follow. The question here will be, whether the medicine caused death, or whether it simply accelerated it: although, in a legal view, that which accelerates, causes.

HIERAPICRA (*Holy bitter*) is a popular aloetic compound, and one death is recorded to have been produced by it in 1837–8. There is reason to believe that it is occasionally used for the purpose of procuring criminal abortion. A man was tried and convicted of this offence at the Aylesbury Lent Assizes, 1857 (*Reg.* v. *White*), and the noxious properties of this compound then became a subject of inquiry. The dose, and the condition of the woman to whom it is administered, will of course affect the answer to this question. At the trial above mentioned, it was properly considered to be a noxious substance within the meaning of the statute. The fact that, under the name of *Pulvis Aloes cum Canellâ*, it was formerly admitted into the British Pharmacopœias, cannot justify the mischievous uses to which it may be put. *Hierapicra* is a snuff-coloured powder, of an intensely bitter taste. It consists of four parts, by weight, of aloes, and one part, by weight, of powdered Canella bark. The proper medicinal dose was formerly fixed at from five to fifteen grains. Its injurious effects on pregnant females are chiefly due to the aloes. This specially affects the rectum, and by contiguity, under violent irritation or purging, may affect the uterus. From the taste and colour which it imparts to liquids, it is not probable that it could be taken by a female unknowingly.

Death has been caused by aloes taken in nitric acid; but in this case the mineral acid was most probably the destructive agent. A singular case occurred in Germany a few years since, wherein a medico-legal question was raised respecting the poisonous properties of Aloes. A woman, aged forty-three, not labouring under any apparent disease, swallowed two drachms of powdered aloes in coffee. Violent purging supervened, and she died the following morning, twelve hours after having taken the medicine. On inspection the stomach was found partially, and the small intestines extensively, inflamed. There were no other particular appearances to account for death, and this was referred to the effect of the aloes.

SAVIN. (JUNIPERUS SABINA.)

This is a well-known plant, the leaves or tops of which contain an irritant poison in the form of an acrid volatile oil of a remarkable odour. They exert an irritant action, both in the state of infusion and powder. They yield by distillation a light yellow oil, on which the irritant properties of the plant depend. The powder is sometimes used in medicine, in a dose of from five to twenty grains. Savin is not often taken as a poison for the specific purpose of destroying life; but this is occasionally an indirect result of its use as a popular means of procuring abortion. In this manner it appears to have proved fatal in one case in 1837-8. From the little that is known of its effects, it acts by producing violent pain in the abdomen, vomiting, and strangury. After death, the gullet, stomach, and intestines, with the kidneys, have been found either much inflamed or congested. It has no action as an abortive, except, like other irritants, by causing a violent shock to the system, under which the uterus may expel its contents. Such a result can never be obtained without placing in jeopardy the life of a woman; and when abortion follows, she generally falls a victim. On the other hand, the female may be killed by the poison without abortion ensuing. In May, 1845, I met with a case in which death had been caused by savin-powder,—abortion having first taken place. Eight ounces of green liquid were found in the stomach, which, with the gullet and the small intestines, was highly inflamed. The poison was easily identified by placing some of the minute portions of the leaves found in the stomach under a microscope. (Med. Gaz. vol. 36, p. 646.) The *oil of savin* is also powerfully irritant. For an account of this, see CRIMINAL ABORTION.

CROTON OIL.

This is an oil extracted from the seeds of the Croton tiglium. It is a powerful drastic purgative, producing, in a large dose, severe purging, collapse, and death. A case occurred in Paris, in 1839, in which a man swallowed by mistake two drachms and a half of croton oil. In three quarters of an hour the surface was cold and clammy, the pulse imperceptible, respiration difficult, and the extremities and face were as blue as in the collapsed stage of cholera. In an hour and a half purging set in; the stools were passed involuntarily, and the abdomen was very sensitive to the touch. The patient complained of a burning pain in the course of the gullet. He died in four hours after swallowing the poison. There was no marked change in the mucous membrane of the stomach!

In June, 1850, I was consulted in a case in which it was supposed that this liquid had been employed for the purpose of destroying life; and, although arsenic was found in the stomach, it became a question to determine what was the fatal dose of this oil. In this instance sixty drops had been sold, mixed with two ounces of linseed oil. This is considered a proper dose for cattle. In man, a dose of from fifteen to twenty drops of the *pure* oil might give rise to excessive purging, and thus cause death by exhaustion. The cases recorded of its fatal operation are very few, and do not enable us to solve this question from observed facts. According to Landsberg, as quoted by Christison (Dispensatory, p. 382), thirty drops of the oil have killed a dog, and Dr. Christison states that he has known four grains of the oil to produce an alarming degree of purging. It is frequently adulterated with castor oil and other substances, and these adulterations must of course influence the dose required to act fatally. In the Medical Gazette there is a report of a case in which a woman died from the effects of an embrocation containing croton oil, with other drugs. A teaspoonful was incautiously given to her: she immediately complained of a hot burning sensation in her throat. She was an aged person, and died in convulsions in three days. (Med. Gaz. vol. 43. p. 41.)

Castor Seeds.

Of castor oil itself nothing need be said. It is not commonly known that the seeds from which this oil is extracted, contain in the embryo an active poison, and that a few of them are sufficient to produce violent purging and death. The following is an instance of poisoning by these seeds,—the only one with which I have met. The deceased, aged eighteen, was the sister of a gentleman who was at the time attending my lectures at Guy's Hospital. The deceased, it appears, ate about twenty castor-oil seeds; one of her sisters ate four or five, and another two. This was on a Wednesday evening. In the night they were all taken ill. About five hours after the seeds were eaten the deceased felt faint and sick; vomiting and purging came on, and continued through the night. On the following morning she appeared like one affected with malignant cholera. The skin was cold and dark-coloured, the features contracted, and the breath cold; the pulse was small and wiry; there was restlessness, thirst, pain in the abdomen, and she lay in a sort of drowsy, half-conscious state. Whatever liquid was taken was immediately rejected, and the matters passed by stool consisted chiefly of a serous fluid with blood. She died in five days without rallying; the two other sisters recovered. On inspection, a very large portion of the mucous membrane of the stomach was found abraded and softened in the course of the great curvature. There was general redness of the organ, and the abraded portion presented the appearance of a granulating surface of a pale rose-colour; it was covered, by a considerable quantity of slimy mucus. The small intestines were inflamed, and the inner surface of them was abraded. The effects produced on the sisters who recovered, bear out the statement of Dr. Christison, that two or three of the seeds will operate as a violent cathartic.

Colchicum (Meadow-Saffron).

Meadow-saffron (Colchicum Autumnale) contains a poisonous alkaloid,—*colchicina*—the effects of which on animals are similar to those of *veratria*, the alkaloid existing in White hellebore. The most noxious part of the plant are the bulbs (or roots) and seeds, but the leaves and flowers have also an irritant action.

Symptoms and Appearances.—In November, 1839, a gentleman swallowed by mistake one ounce and a half of *wine* of colchicum. He was immediately seized with severe pain in the abdomen: other symptoms of irritation came on, and he died in seven hours. No examination of the body was made! In another instance, in which an ounce of the wine was taken, death occurred in thirty-nine hours. (Schneider's Annalen, vol. 1. p. 232.) In one case in which this dose was taken, the person recovered after suffering from cramps in the limbs and twitching of the tendons. (L'Union Mèd., Aug., 24, 1848.) A woman, æt. fifty-six, suffering from rheumatism, for whom wine of colchicum had been prescribed, took by mistake an ounce of the wine of the seeds, in divided doses, in twelve hours. She suffered from nausea, violent and profuse vomiting, slight purging, with heat and burning pain in the throat, great thirst, cold clammy skin, feeble pulse, pain in the stomach, and pain in the forehead. Inflammation of the stomach supervened, and the retching, vomiting, thirst, and pain continued for three days. She then recovered. (Amer. Jour. Med. Sci., Jan., 1857: and Brit. and For. Rev., vol. 19. 1857, p. 409.) In a well-marked case of poisoning by the *wine* of colchicum, reported by Mr. Fereday, two ounces were taken. The symptoms did not come on for an hour and a half; there was then copious vomiting of a yellow fluid, severe pain with great tenderness in the abdomen, tenesmus and thirst. The patient died in forty-eight hours, without being convulsed or manifesting any sign of cerebral disturbance. The chief morbid *appearance* was a patch of redness in the mucous membrane of the stomach, near the cardiac orifice: the intestines were slightly inflamed. The head was not examined. (Medical Gazette, vol. 10. p. 161: see also Casper, Ger. Med., p. 450.) A case of poisoning by the medicinal administration of colchicum has been communicated to me by Mr. Mann, of Bartholomew Close. Three and a half drachms of the wine of colchicum were taken in divided doses, and caused death on the fourth day. There was no inflammation of the mucous membrane, but simply extravasation of blood into the mucous follicles. The mucous membrane has been found softened in two cases of poisoning by the tincture. In two other cases, in which an ounce and a half of the *tincture* was taken, and death ensued in forty-eight hours, no morbid appearances were found. (Casper, Ger. Med., 1857, p. 451.) For a case of alleged poisoning by wine of colchicum, see Casper's Vierteljahrschrift, 1860, vol. 1. p. 1.

BLACK AND WHITE HELLEBORE.

There are several species of Hellebore; but the two plants which are most commonly used as poisons under this name, are the Black and White Hellebore.

Symptoms and Appearances.—According to Wibmer, the roots of the Black Hellebore possess the greatest activity: but the leaves are also highly poisonous when used in the form of infusion. By long boiling the poisonous properties of the plant are diminished, probably owing to the loss of the volatile principle, which is an acrid oil. The roots and leaves have a local irritant action, producing violent vomiting and purging in small doses, with severe pain in the abdomen, followed by cold sweats, convulsions, insensibility, and death. The powdered root, in a dose of a few grains, acts like a drastic purgative. In a case reported by Morgagni, half a drachm of the aqueous extract killed a man, aged fifty, in eight hours. The symptoms were severe pain in the abdomen and violent vomiting. After death the whole of the alimentary canal was found inflamed, but especially the large intestines. (Wibmer, op. cit. HELLEBORUS.) A case is quoted by the same writer, in which a table-spoonful of the finely-powdered root (taken by mistake for rhubarb) caused severe symptoms of irritant poisoning, which did not disappear for four hours. The man recovered on the fourth day. The experiments performed by Orfila on animals show that this poison acts like a *local* irritant when applied to a wound. (Op. cit. vol. 2. p. 369.) Hellebore is a favourite remedy for worms with quacks and rural doctresses. It is not, therefore, surprising that it should be occasionally administered in an overdose, and cause death.

OIL OF TURPENTINE.

The few cases in which this liquid has produced any noxious symptoms have occurred among children. From these it appears to have rather the effects of a neurotic (narcotic) than an irritant poison. In a dose of three drachms it has produced intoxication. A dose of a table-spoonful caused in a child aged eighteen months, symptoms bearing a strong resemblance to those occasioned by an overdose of opium, although they were not so rapidly manifested. (See case by Mr. Johnson, Med. Times, Oct. 11, 1851, page 380.) In three hours there was complete insensibility,—stertorous breathing, strongly contracted pupils, rapid and weak pulse,—coldness of surface, paleness of the countenance,—general relaxation of the muscles, with occasional convulsive movements. In no instance yet recorded has this oil caused death. A case of recovery in an infant that had swallowed four ounces is recorded in another work (ON POISONS).

A case in which this liquid was criminally administered to an infant, was the subject of a trial at the Central Criminal Court, December, 1856 (*Reg.* v. *Rodanbosh*): it did not destroy life, but the child suffered for some time from the effects. The defence was, that the oil of turpentine was poured down the child's throat by the mother with a view to cure it of a cough! She was acquitted.

OIL OF TAR.

This is a powerful vegetable irritant. In 1832, about ten drachms of it caused the death of a gentleman, to whom it had been sent by mistake for a black draught. The party who sent it was tried for manslaughter, but acquitted. The irritant properties are owing to creasote, carbolic acid, and other compounds.

MOULDY BREAD.

There is a common article of food, namely *bread*, upon the occasionally noxious effects of which some observations have been made by toxicologists. (In the Annales d'Hygiène, 1843, pp. 35 and 347., will be found communications on this subject from MM. Guérard, Chevallier, and Gaultier de Claubry: also in the same journal, 1852, vol. 1. p. 350.) The changes which take place in the decomposition of flour and bread, and the production of various kinds of *mouldiness*, are here investigated, together with the effects of such bread upon the animal system. It would appear that in some parts of France the peasantry manifest no repugnance to the eating of *mouldy bread*; and that in many instances the practice appears to be attended with no ill effects. The nature of the mould produced, however, is subject to great variation, and it is not improbable, as M. Chevallier suggests, that in some cases a poisonous principle is actually developed. In two instances of children, who had partaken of mouldy rye bread, symptoms resembling those of irritant poisoning supervened. The countenance was red and swollen; the tongue dry; the pulse quick; there were violent colics, with pain in the head, and intense thirst. Vomiting and purging supervened with a state of collapse, but the children eventually recovered. These symptoms were ascribed to the production of "*mucor mucedo*" in the bread. In 1829, alarming effects having followed from the use of a certain kind of bread in Paris, M. Barruel was called upon to determine whether any irritant poison had or had not become accidentally intermixed with it. The bread was simply in a mouldy state; there was no trace of poison. It is unnecessary to enter further into this subject; the facts adduced, together with experiments performed on animals, show that bread, in a state of mouldiness or decay, may not only produce symptoms of poisoning, but actually cause death; and as it is impossible to distinguish the noxious from the innoxious kind of mould, the use of all bread in such a condition should be avoided.

Even *fresh bread* may occasionally seriously affect the body. The *brown bread* of London has been known to produce giddiness, lethargy, and other unpleasant symptoms, indicative of an affection of the brain and nervous system. This has been ascribed, with some probability, to the presence of Darnel seeds in the corn.

CAROB OR LOCUST BEAN.

The locust beans or *locust nuts* have been much used in England for the fattening of cattle; but in a few cases in which they have been eaten by children, they are supposed to have occasioned violent irritation; and in one case (March 1857), a boy, aged ten years, died in about sixteen hours, apparently from their poisonous action on the body. The chief symptoms during life were pain in the head, vomiting, and purging, with clenching of the hands, and a spasmodic action of the muscles of the face. On inspection, the stomach and intestines were found much inflamed. The viscera were carefully examined by Mr. Watson of Bolton, but no poison could be detected. Another fatal case, as it was alleged from eating locust nuts, occurred subsequently in London, and was the subject of an inquest before Mr. Wakley. The facts at present scarcely admit of an explanation. The nuts contain no substance injurious to animals, and as it is alleged that many human beings have eaten them with impunity, the effects produced in the above cases may have been dependent on idiosyncrasy in those who have suffered (ante, page 7).

Other vegetable irritants might be enumerated, but these are the principal which have given rise to medico-legal inquiries. The treatment of such cases must depend on the nature of the symptoms; the main object should always be to remove the poison either from the stomach or bowels, by mild emetics or purgatives (castor-oil), with as little delay as possible. The nature of the poison is commonly apparent from the circumstances; for these cases, if we except poisoning by Savin, which is sometimes criminally administered, are generally the result of accident. These vegetable poisons are beyond the reach of chemical processes:—they are only to be recognized either by their physical properties, or by the botanical characters of the berries, seeds, or leaves.

CHAPTER 17.

ANIMAL IRRITANTS — CANTHARIDES OR SPANISH FLIES — SYMPTOMS AND EFFECTS — ANALYSIS. POISONOUS FOOD — FISH — MUSSELS — SALMON — CHEESE — SAUSAGES — DISEASED FLESH OF ANIMALS.

CANTHARIDES. (SPANISH FLIES.)

Symptoms and effects.—Cantharides are not unfrequently administered, either in the state of powder or tincture, for the criminal purpose of procuring abortion. When taken in *powder*, in the dose of one or two drachms, it gives rise to the following symptoms:—a burning sensation in the throat, with great difficulty of swallowing—violent pain in the abdomen, with nausea, and vomiting of bloody mucus:—there is also great thirst and dryness of the fauces, but in a few cases observed by Mr. Maxwell, salivation was a prominent symptom. As the case proceeds, pain is commonly experienced in the loins, and there is an incessant desire to void urine, but only a small quantity of blood or bloody urine is passed at each effort. The abdominal pain becomes of the most violent griping kind. Purging supervenes, but this is not always observed:—the matters discharged from the bowels are mixed with blood and mucus, and there is often tenesmus (straining). In these, as well as in the vomited liquids, shining green particles may be commonly seen on examination, whereby the nature of the poison taken, will be at once indicated. After a time, there is severe priapism, and the genital organs are swollen and inflamed both in the male and female. In one instance, observed by Dr. Pereira, abortion was induced, probably owing to excitement of the uterus, from the severe affection of the bladder: for there is no proof that this substance acts directly on the uterus to induce abortion. With respect to the aphrodisiac propensities said to be caused by cantharides, these can seldom be excited in either sex, except when the substance is administered in a dose which would seriously endanger life. When the case proves fatal, death is usually preceded by faintness, giddiness, and convulsions. The *tincture* of cantharides produces similar symptoms: — they are, however, more speedily induced, and the burning sensation and constriction of the throat and stomach are more strongly marked: this symptom is often so severe as to render it impossible for the individual to swallow; and the act of swallowing gives rise to excruciating pain in the throat and abdomen. This poison has been in some cases wantonly used, and with great danger to life, with a view of exciting sexual feelings in females. The doses in which it has been given have been such as to cause symptoms of irritant poisoning. In Nov. 1859, six female servants in a gentleman's family, as well as the master and mistress, were attacked with all the symptoms of poisoning by cantharides. It appeared that the coachman of the family had, shortly before the occurrence, purchased an ounce of this poison; that he had put the cantharides into beer and coffee, and had thus poisoned the whole household. He was tried, but acquitted of any indictable offence, on the ground that his intent was not to murder. It was this case which led to an alteration in the law.

Appearances.— In one well-marked case of poisoning by this substance, the whole of the alimentary canal, from the mouth downwards, was in a state of inflammation, as well as the ureters, kidneys, and internal organs of generation. The mouth and tongue seemed to be deprived of their mucous membrane. In another instance, in which an ounce of the tincture was swallowed, and death did not occur for fourteen days, the mucous membrane of the stomach was not inflamed; but it was pulpy, and easily detached. The kidneys were, however, inflamed. The brain has been found congested, and ulceration of the bladder is said to have been met with. There are few fatal cases reported, in which the appearances have been accurately noted; indeed, the greater number of those who have taken this poison have recovered. In a case which occurred to Mr. Saunders, death took place in about twenty-four hours. The deceased must have taken the greater part of half an ounce of cantharides in powder. The symptoms were such as have been above described. On inspection, the vessels of the brain were filled with dark-coloured blood, and the ventricles were distended with serum. Both lungs were highly engorged with dark-coloured blood. The gullet was partially inflamed, and there were patches of inflammation on the mucous coat of the stomach, which had become detached in several places. The same inflammatory appearance existed in the small intestines, in the folds of which the powder of cantharides was abundantly seen. The vessels were distended, and the liver was engorged with dark blood. The gall-bladder was much distended with bile, and none of this secretion appeared to have passed into the bowels. The spleen and kidneys were highly congested: the ureters were inflamed; the bladder was contracted and empty, and its internal surface pale. The glittering of the particles of cantharides in the viscera during the inspection by candlelight was very remarkable. (Medical Times, Feb. 3, 1849, p. 287.) Cantharides have no local action of a chemical nature. The poison is pure *irritant,* and the effects observed are entirely due to irritation and inflammation.

Fatal dose.—The *quantity* of this poison required to produce serious effects, or to destroy life, has been a frequent subject of medico-legal inquiry. Dr. Thomson represents the medicinal dose of the powder to be from one to three grains. On a late criminal investigation one medical witness stated, that one grain was the maximum dose, but this is an under-statement: according to Thomson it is *three* grains. The dose of the London Pharmacopœial tincture is from ten minims gradually increased to one fluid-drachm,—of the powder, from *one* to *two grains.* (Pereira, Mat. Med. part 2. vol. 2. p. 754.) Doses above this, whether of the powder or the tincture, are likely to be injurious, and to give rise to symptoms of poisoning. On a trial which took place at Aberdeen, in 1825, it appeared that a drachm of the powder had been administered: severe symptoms followed, but the person recovered. Dr. Dyce, the medical witness, said he had given ten grains of the powder as a medicinal dose. In three cases, observed by Mr. Maxwell, a drachm of the powder mixed with six ounces of rum was taken by each person: they were robust, healthy negroes,—they suffered severely, but recovered in about ten days: in these cases, irritation of the urinary organs did not appear until after the men had been bled. The *smallest quantity* of powder which has been known to destroy life, was in the case of a young female, quoted by Orfila,—the quantity taken was estimated at *twenty-four grains* in two doses. She died in four days; but as abortion preceded death, it is difficult to say how far this may have been concerned in accelerating that event. Her intellect was clear until the last. In one instance a man recovered after having taken twenty grains of the powder (Ed. Med. and Surg. Journ. Oct. 1844); and in another, after having taken *two drachms* (Med. Gaz. vol. 42. p. 873.) An *ounce* of the tincture has been known to destroy life. It was taken by a boy, aged seventeen, and he died in fourteen days. This, I believe, is the smallest dose of the tincture which has proved fatal. Four drachms and even six drachms have been taken; and although the usual symptoms followed, the parties did well. The last case was the subject of a trial at the Central Criminal Court, in September, 1836. Six drachms of the tincture were administered to a girl, aged seven-ten: the medical witness was required to say whether half an ounce was sufficient to kill a person, as also what proportion of cantharides was contained in an ounce of the tincture; he said, five grains. One ounce of the tincture (P.L.) is equivalent to six grains of the powder; but considering that the principle *cantharidine* is the substance on which the poisonous properties depend, it is not unlikely that the tincture varies in strength according to its mode of preparation. A case is quoted by Pereira, from Dr. Hosack (Mat. Med. vol. 2. pt. 2. p. 750), in which it is said six ounces of the tincture were taken by a man without causing dangerous symptoms! This must have been an extraordinarily weak preparation: and probably the insects from which the tincture was made, contained little or no cantharidine. The same writer mentions a case within his own knowledge, in which one ounce of the tincture caused serious symptoms.

Chemical analysis.—Orfila has applied reagents to detect *cantharidine* in the tincture; but without success. It has been recommended to digest the suspected solid or the liquid contents of the stomach evaporated to an extract, in successive quantities of ether,—to concentrate these ethereal solutions by slow evaporation, and then observe whether the concentrated liquid applied to the skin of the lips produces vesication or not: the medical jurist being expected in such cases to make himself the subject of experiment. By this method Barruel discovered cantharides in some chocolate. (Ann. d'Hyg. 1835, vol. 1. p. 455.) In an elaborate essay on this subject (Ann. d'Hyg. Oct. 1842), M. Poumet recommends that the suspected liquids, mixed with alcohol, should be spread on sheets of glass, and allowed to evaporate spontaneously to dryness. The shining scales will then be seen, on examining, by reflected light, either one or both surfaces of the glass. This process answers only for the detection of the powder.

The evidence of the presence of cantharides, or of their having been taken, is necessary to support a criminal charge; for however unambiguous the symptoms produced by this poison may appear to be in its peculiar effects on the generative and urinary apparatus, the medical jurist should be aware that similar symptoms may proceed from disease. An important case of this kind has been reported by Dr. Hastings. (Med. Gaz. vol. 12. p. 431.) A young lady was suddenly seized with vomiting, thirst, pain in the loins, strangury, and considerable discharge of blood from the urethra: the generative organs were swollen and painful. She died in four days. She was governess in a family, and there was some suspicion that she had been poisoned by cantharides. The stomach and the kidneys were found inflamed, and the bladder also; this contained about two ounces of blood. There was no trace of poison; and indeed, it was pretty certain, from the general evidence, that none could have been taken.

Poisonous Food.

Certain kinds of animal food are found to produce, occasionally, symptoms resembling those of irritant poisoning. In some cases this poisonous effect appears to be due to idiosyncrasy; for only one person out of several may be affected. These cases are of importance to the medical jurist, since they are very likely to give rise to unfounded charges of criminal poisoning. In the absence of any demonstrable poison, we must test the question of idiosyncrasy by observing whether more than one person is affected, and whether the same kind of food, given to animals, produces symptoms of poisoning. If, with this latter condition, several persons are affected simultaneously, we cannot refer the effects to idiosyncrasy: they are most probably due to the presence of an animal poison. Among the articles of food which have given rise to symptoms of poisoning, may be mentioned,—

Poisonous Fish. Mussels.—Of all the varieties of shell-fish, none have so frequently given rise to accidents as the common mussel. The symptoms which it produces, are uneasiness and sense of weight in the stomach, sensation of numbness in the extremities; heat, dryness, and constriction in the mouth and throat; thirst, shivering, difficulty of breathing, cramps in the legs, swelling and inflammation of the eyelids, with a profuse secretion of tears, and heat and itching of the skin, followed by an eruption resembling nettle-rash. These *symptoms* are sometimes accompanied by colic, vomiting, and purging. They may occur within ten minutes or a quarter of an hour; but their appearance has been delayed for twenty-four hours. There is generally great exhaustion and debility. These symptoms have proceeded from the eating of not more than ten or twelve mussels. Two cases, reported by Dr. Christison, proved fatal, the one in three, and the other in about seven hours. In general, however, especially when there is free vomiting, the patients recover. In the inspection of the two above-named fatal cases, no appearance was found to account for death. A case in which two mussels produced in a boy aged ten, alarming symptoms, followed by an eruption resembling scarlatina and nettle-rash, will be found elsewhere reported (Guy's Hosp. Reports, Oct. 1850, p. 213). In July, 1860, a number of persons living at Tralee were poisoned under the following circumstances. A woman picked up some mussels which she found at the bottom of the basin of the ship canal. She distributed them among her neighbours, and during the night twenty-one persons who had eaten of them were attacked with symptoms of having been poisoned. Three children had died, and six individuals were in imminent peril. The rest were soon out of danger. Eight of the twenty-one persons attacked were adults. (Med. Times and Gazette, July 28, 1860.)

The poisonous action of mussels can neither be referred to putrefaction nor disease; nor in all cases to idiosyncrasy, since in one instance those mussels only which had been taken from a particular spot were poisonous: all persons who partook of them suffered, and a dog was killed to which some of them were given. From a case which occurred to M. Bouchardat, it would appear that copper is sometimes present, and may be the cause of the poisonous effects. Two women were poisoned by mussels, and he found on analysis sufficient copper in the fish to account for the symptoms of irritation from which they suffered. (Ann. d'Hyg. 1837, vol. 1. p. 358.) Copper is not, however, present in all cases, and it is therefore probable that there is in some, if not in all instances, an *animal poison* present in the fish. (See Ann. d'Hyg. 1851, vol. 1. p. 387, vol. 2. p. 108.) *Oysters* and *Periwinkles* have occasionally given rise to similar symptoms. *Salmon*, sold in the state of pickled salmon, or even *Herrings* salted, may also act as irritants: this may be due to the fish being partially decayed before it is used, or to the noxious effects of the pickle. For some remarks by Dr. Hamilton on the poisonous properties of fish see the Pharmaceutical Journal, Jan. 1853, p. 344.

Cheese.—The symptoms produced by cheese have been those of irritant poisoning. The nature of the poison is unknown. In some cases the irritant property is undoubtedly due to a putrefied state of the curd, or to the production of an irritant oil. Again, it has been supposed that the poison is occasionally derived from certain vegetables on which the cows feed. In 1858 a case was referred to me for examination, in which twenty-five persons had suffered from vomiting and purging more or less violent, owing to their having partaken of cheese. The only articles of food taken in common were bread, beer, and cheese. The bread and beer were excluded from any suspicion of containing poison. All the persons recovered. On a close examination of the cheese I found it to be strongly acid: it had an offensive musty smell, and yielded a quantity of acrid oil to ether. It had not been properly pressed, and the casein had undergone a chemical change. The ashes yielded copper and lead in traces. The cheese had acquired irritant properties, not from the presence of any poisonous matter added to it, but from partial decay. There was abundant evidence that cheese from the same dairy had been eaten without causing any injurious symptoms. This negative evidence, however, is quite consistent with one cheese acquiring noxious properties.

Sausage poison. — The symptoms caused by *sausage-poison* are very slow in appearing, — sometimes two, three, or four days may elapse before they manifest themselves: they partake of the narcotico-irritant character. This poison is of a formidable kind: its effects have been chiefly observed in Germany. In the Medical Gazette for Nov. 1842, there is an account of the cases of three persons, who had died from the effects of liver-sausages, which had been made from an apparently healthy pig, slaughtered only a week before. The inspection threw no light on the cause of death. The poisonous property is supposed to depend on a *partial* decomposition of the fatty parts of the sausages. It is said, that when extremely putrefied they are not poisonous. In a case in which I was consulted, a few slices of a German sausage, evidently of old manufacture, caused the death of a child, with violent symptoms of irritation of the stomach and bowels. I examined a portion of the sausage: it contained no poisonous matter which admitted of detection. The fatty portions were rancid, and the lean portions very dry. There was no doubt, however, that it had been the cause of the symptoms and death of the child. Dr. Tripe has published a complete account of the effects produced by sausage poison (Brit. and For. Med. Rev., Jan. 1860, page 197). It appears that in November 1859, sausages made and sold by a pork-butcher, at Kingsland, were eaten more or less by sixty-six persons, of whom sixty-four were attacked with violent symptoms in from three and a half to thirty-six hours subsequently to the meal. One case only proved fatal, on the seventh day. No symptoms appeared on this man until after the lapse of six hours. It seems that he had eaten one of the sausages raw and three cooked. He was attacked with severe vomiting, and purging followed by shivering:—there was pain in the abdomen: violent headache and great prostration. The pulse was feeble and quick, and there was delirium. These symptoms underwent a remission, but he had a relapse, became comatose, and died on the seventh day. Latterly, he chiefly complained of pain in the bowels. Dr. Letheby found, on inspection, no signs of inflammation or of the action of an irritant in the stomach. The small intestines were much inflamed at the lower end, and the gall-bladder was distended. The other organs were healthy. The viscera contained no vegetable or mineral poison. The sausages were made with heifer-beef, pork-fat, sage, and pepper. There was no evidence of anything noxious about them, and a chemical analysis yielded nothing of a poisonous nature. There could, however, be no doubt that the sausages had caused the symptoms and death:—the food in this case acting as a narcotico-irritant poison. Other persons suffered from burning in the throat and stomach, followed by vomiting and purging: then giddiness or confusion in the head, and in some there was delirium. In the man who died, the delirium was well marked, and the eyes were red. In those persons who recovered, the noxious animal matter was probably early thrown off by vomiting and purging.

Pork. Bacon.—These common articles of food occasionally give rise to symptoms so closely resembling those of irritant poisoning, as to be easily mistaken for them. In some cases, the effect appears to be due to idiosyncrasy; but in others it can only be explained by supposing the food to have a directly poisonous action. The noxious effects of pork have been particularly shown by the cases published by the late Dr. MacDivitt. (Ed. Med. and Surg. Jour. Oct. 1836.) As pork is sometimes salted in leaden vessels lead may be found in it: but fresh pork has been observed to have a noxious action.

There is no doubt that *epizootic disease* may be a frequent cause of rendering animal food poisonous. *Partial decay* may also render unwholesome and injurious the flesh of the most healthy animal. What the nature of the poison is which is thus produced, has not yet been determined. Liebig imagines that its noxious effects are owing to the production of a fermenting principle, and that this operates fatally by producing a kind of fermentation in the blood. It has been said that the symptoms of irritant poisoning produced by animal food seldom appear until five or six hours after the meal. This may be generally true, but in certain instances it has undoubtedly happened that the symptoms have come on in from a quarter to half an hour after the noxious food was taken.

Much of the butcher's meat, fish, and game sold to the poor in this metropolis is in a state of decay, and is quite unfit for human food. The decayed meat is no doubt a prolific source of disease. In January 1851, the family of a surgeon near London were all affected with symptoms resembling irritant poisoning, after having partaken of a hare which had been stewed in a clean earthen vessel. The surgeon informed me that on the second day, his wife was seized with vomiting and purging, giddiness, heat in the throat, and general numbness, with inflamed eyes. Other members of the family vomited, and in the course of a few days the symptoms disappeared. I examined the vomited matter, and found it to consist of portions of the hare partially digested, but in a state of putrefaction, so that there was abundant evidence of sulphuretted hydrogen in the liquid. There was no mineral poison of any kind, although the symptoms, it will be observed, were rather like those occasioned by arsenic. It had been remarked by the family, that a silver spoon, which had been used in serving out this unwholesome food, was turned of a brown colour, no doubt from the chemical action of sulphuretted hydrogen; and this may be taken as a good domestic test of the putrefied condition of such food. Nature generally applies an appropriate remedy, in the fact that the food itself produces copious vomiting and purging.

Cases of this kind must be distinguished from those in which *poisoned game* is sold to the public. The game may be quite free from putrefaction, but noxious from the poisoned grain which may have caused death. It is a very common practice to steep grain in a solution of arsenic, previous to sowing, and pheasants, partridges, and other birds may be accidentally destroyed by eating the grain. In some instances, grouse and other game are maliciously destroyed by corn saturated in arsenic being laid in the localities where the birds abound. There is no law to prevent the sale of poisoned game by poulterers, and there is no precaution which can be taken by the purchasers, except by observing whether the birds have or have not been shot. (See on this subject, ON POISONS; also a letter by Dr. Fuller, Med. Gaz. vol. 42. p. 1036.)

NEUROTIC POISONS.

(Narcotic or Cerebral and Spinal Poisons.)

CHAPTER 18.

OPIUM—SYMPTOMS—PERIOD OF COMMENCEMENT—APPEARANCES—QUANTITY REQUIRED TO DESTROY LIFE—DEATH FROM SMALL, AND RECOVERY FROM LARGE DOSES—ITS ACTION ON INFANTS—PERIOD AT WHICH DEATH TAKES PLACE—POISONING BY POPPIES—GODFREY'S CORDIAL—DALBY'S CARMINATIVE—PAREGORIC ELIXIR—DOVER'S POWDER—BLACK DROP—SEDATIVE SOLUTION—MORPHIA AND ITS SALTS—TESTS FOR MORPHIA AND MECONIC ACID—PROCESS FOR DETECTING OPIUM IN ORGANIC MIXTURES.

Opium.

Symptoms.—The symptoms which manifest themselves when a large dose of opium or its tincture has been taken, are in general of a uniform character. They consist in giddiness, drowsiness, a strong tendency to sleep, stupor, succeeded by perfect insensibility, the person lying motionless, with the eyes closed as if in a sound sleep. In this state he may be easily roused by a loud noise, and made to answer a question: but he speedily relapses into stupor. In a later stage, when coma has supervened with stertorous breathing, it will be difficult, if not impossible, to rouse him. The pulse is at first small, quick, and irregular, the respiration hurried, and the skin warm and bathed in perspiration—sometimes livid: but when the individual becomes comatose, the breathing is slow and stertorous: the pulse slow and full. The skin is occasionally cold and pallid. The pupils are, in the early stage, contracted; in the later stage, and when progressing to a fatal termination, they may be found dilated. In a case referred to me in 1846, one pupil was contracted and the other dilated. They are commonly quite insensible to light. The expression of the countenance is placid, pale, and ghastly: the eyes are heavy, and the lips are livid. Sometimes there is vomiting, or even purging; and, if vomiting takes place freely before stupor sets in, there is great hope of recovery. This symptom is chiefly observed when a large dose of opium has been taken; and it may then be, perhaps, ascribed to the mechanical effect of the poison on the stomach. The odour of opium is occasionally perceptible in the breath. Nausea and vomiting, with headache, loss of appetite and lassitude, often follow on recovery. In cases likely to prove fatal, the muscles of the limbs feel flabby and relaxed, the lower jaw drops, the pulse is feeble and imperceptible, the sphincters are in a state of relaxation, the temperature of the body is low, there is a loud mucous rattle in breathing, and convulsions are sometimes observed before death: but these are more commonly met with in children than in adults. One of the marked effects of this poison is to suspend all the secretions except that of the skin. During the lethargic state the skin, although cold, is often copiously bathed in perspiration. It is a question yet to be determined, whether this may not be a medium by which the poison is principally eliminated.

These symptoms usually *commence* in from *half an hour* to *an hour* after the poison has been swallowed. Sometimes they come on in a few minutes, especially in children; and at other times their appearance is protracted for a long period. In a case reported by Dr. Skae, the person was found totally insensible in *fifteen minutes*. As we might expect, from the facts connected with the absorption of poisons, when the drug is taken in the *solid* state, the symptoms are commonly more slow in appearing, than when it is *dissolved* in water or alcohol. It has been frequently observed, in cases of poisoning by this drug, that a person has recovered from the first symptoms, and has then had a relapse, and died. There is some medico-legal interest connected with this state, which has been called secondary asphyxia from opium, although there appears to be no good reason for giving to it this name. In December, 1843, a gentleman swallowed a quantity of laudanum, and was found labouring under the usual symptoms. The greater part of the poison was removed from the stomach by the pump: and he so far recovered from his insensibility as to be able to enter into conversation with his medical attendant; but a relapse took place, and he died the following night. The case of the *Hon. Mrs. Anson* (Jan. 1859), for the particulars of which I am indebted to Mr. Arthur Durham, furnishes another illustration of this singular condition. This lady swallowed, while fasting, an ounce and a half of laudanum by mistake. In a quarter of an hour emetics were given, but she did not vomit for half an hour: and she was not treated medically for two hours and a half. The matter then drawn from the stomach had no smell of laudanum. She was quite unconscious, and had lost the power of swallowing. After remaining in this comatose state for upwards of nine hours, the patient revived, the face became natural, the pulse steady, the power of swallowing returned, she was able to recognize her daughters, and, although in a thick voice, to give an account of the mistake she had made. This state lasted about five minutes—the torpor then returned, she sank into profound coma, and died fourteen hours after the poison had been taken. It is not improbable that, in these cases, death may be occasioned by the accumulation of the poison, carried by the absorbents into the system; *i. e.* the morphia may be more rapidly carried into the system than it is eliminated from it. A remarkable case illustrative of this *remittent* form of poisoning by opium has been published by Mr. Kirby. (Dubl. Med. Press, Dec. 24, 1845, p. 406.)

Appearances.—In a case which proved fatal in fifteen hours, the vessels of the head were found unusually congested throughout. On the surface of the anterior part of the left hemisphere there was an ecchymosis, apparently produced by the effusion of a few drops of blood. There were numerous bloody points on the cut surface of the brain:—there was no serum collected in the ventricles. The stomach was quite healthy. Fluidity of the blood is mentioned as a common appearance in cases of poisoning by opium. There is also engorgement of the lungs: most frequently observed, according to Dr. Christison, in those cases which have been preceded by convulsions. (Op. cit. p. 732.) Among the external appearances there is often great lividity of the skin. Extravasation of blood on the brain is rarely seen;—serous effusions in the ventricles, or between the membranes, are sometimes met with. The stomach is so seldom found otherwise than in a healthy state, that the inflammatory redness said to have been occasionally seen, may have been due to accidental causes. When tincture of opium has been taken and retained on the stomach, increased redness of the mucous membrane may occasionally be produced by the alcohol alone. In a case of poisoning by a large dose of tincture of opium, Dr. Sharkey found the following appearances twelve hours after death:—the body warm and rigid; the stomach healthy, containing a quantity of gruel-like fluid, without any smell of opium. The intestinal canal and all the other viscera were healthy. The veins of the scalp, as well as of the dura mater and sinuses, were gorged with blood; but there was no effusion in any part of the brain. The contents of the stomach yielded no trace of morphia or meconic acid, but there was no doubt that death had been caused by opium, taken the previous night. (Med. Gaz., vol. 37. p. 235.) A case was communicated to me by Dr. Ogston, which was the subject of a trial at the Aberdeen Autumn Circuit, in Sept. 1853, in which a child, aged six months, died in a few hours from a dose of sixty drops of wine of opium. The brain was congested to a marked extent. Although the dose was comparatively large, and death rapid, there was no decided indication of the presence of opium in the stomach. From this account of the appearances in the dead body, it will be seen that there is nothing but a fulness of the vessels of the brain, which can be looked upon as specially indicative of poisoning by opium, and even this is not always present. This congested condition of the brain, however, if it exist, can furnish no evidence of poisoning when taken alone, since it is so frequently found, as a result of morbid causes, in otherwise healthy subjects.

Quantity required to destroy life.—The medicinal *dose* of opium, in *extract* or *powder*, for a healthy adult, varies from half a grain to two grains. Five grains would be a very full dose. The medicinal dose of the *tincture* is from ten minims to one drachm, —as an average, from thirty to forty minims. The *smallest dose of solid opium* which has been known to prove fatal to an adult was in a case reported by Dr. Sharkey, of Jersey. A man, aged thirty-two, died very speedily in a convulsive fit, after having taken two pills, each containing about one grain and a quarter of extract of opium. This quantity is equivalent to *four grains* of crude opium. (Med. Gaz., vol. 37. p. 236.) It is stated that Henrietta Maria, the Queen of Charles I., was destroyed by a dose of three grains of opium. The *smallest fatal dose of the tincture* in an adult, which I have found recorded, is *two drachms.* The case is reported by Dr. Skae. (Ed. Med. and Surg. Journ. July, 1840.) The patient was a robust man, aged fifty-six:—he swallowed the tincture at ten in the evening, and died under the usual symptoms on the following morning; the case having lasted only twelve hours. The quantity actually swallowed, however, appears to be involved in some doubt; for it is subsequently stated (p. 160) that *half an ounce* of laudanum may have been taken. Very large doses of the tincture have frequently been taken without proving fatal. I have elsewhere recorded a case in which five ounces of laudanum were taken even without producing sleep, and the patient recovered. (Guy's Hosp. Reports, Oct., 1850, p. 220.)

There is a difference of opinion respecting the strength of *laudanum*, or the pharmacopœial tincture of opium. According to some, one fluid drachm, or sixty minims of the tincture, contains *five grains* of opium, while the London Pharmacopœia assigns only about *three grains.* The strength of the tincture, as it is procured of different druggists, varies greatly. (See Pereira, Mat. Med., vol. 2. part 2. p. 647; also Lancet, March 12, 1853, p. 251.)

Action of opium on infants.—In connection with this subject, it is important for a medical jurist to bear in mind that *infants* and young persons are liable to be killed by very small doses of opium: they appear to be peculiarly susceptible of the effects of this poison. Dr. Ramisch, of Prague, met with an instance of a child, four months old, that was nearly killed by the administration of one grain of Dover's powder, containing only the tenth part of a grain of opium;—the child suffered from stupor and other alarming symptoms. The following case occurred in June 1822. Four grains of Dover's powder (containing less than half a grain of opium) were given to a child four years and a half old. It soon became comatose, and died in seven hours. Death was referred to inflammation of the throat, and the jury returned the usual unmeaning verdict of "Died by the visitation of God;" but there was no doubt, from the evidence, that death was caused by the opiate medicine. Dr. Kelso met with an instance in which a child, nine months old, was killed in nine hours by four drops (minims?) of laudanum, equal to only *one-fifth part of a grain* of opium: it was much convulsed before death. A case is referred to in the Medical Gazette, in which two drops (minims?) of laudanum, equal to the *tenth part of a grain* of opium, killed an infant. The following is a more recent illustration of the fatal effects of a similar dose. A nurse gave to an infant, five days old, *two drops* (minims?) of laudanum, about three o'clock in the morning. Five hours afterwards the child was found by the medical attendant in a state of complete narcotism. It was revived by a cold bath, but a relapse came on, and it died the same evening, about eighteen hours after the poison had been given to it. On inspection, the brain and abdominal viscera were found in a perfectly healthy state, and there was no smell of opium in the stomach. (Prov. Med. Journ. Oct. 28, 1846, p. 519.) The fatal dose here, as in the former case, was equal to the tenth part of a grain of opium, and to only an infinitesimal dose of morphia! Dr. E. Smith has reported a case (Lancet, April 15, 1854), in which an infant, *seven days* old, died in eighteen hours from the effects of one *minim* of the tincture, or the *twelfth part of a grain* of opium. Coma with the usual symptoms was complete in half an hour. On inspection, the heart was found distended with black liquid blood: the lungs were collapsed but not congested. The brain was congested, but there was no effusion either into the ventricles or on the surface. The foramen ovale was still quite open. (See also Med. Times and Gazette, April 15, 1854, p. 386.) The smallest fatal dose recorded (in an infant) was in a case communicated to me by Dr. Edwards of Liverpool (November, 1857). An infant, four weeks old, died from the symptoms of poisoning by opium, in seven hours after a dose of paregoric elixir, equivalent to *one-ninetieth* of a grain of opium, had been administered to it. With a knowledge of these facts, it is not surprising that infants are occasionally destroyed by opium under circumstances in which an adult would not suffer. In December, 1860, an inquiry took place at Chester respecting the death of a child, aged six weeks, under the following circumstances. A fomentation composed of laudanum and gin was applied to the side of the mother, and the child was put to the breast shortly afterwards. The child fell into a sleep from which it did not awaken, and died, in spite of treatment, the next morning. The cause of death was left obscure owing to the imperfect manner in which the inquiry was conducted: but it is not improbable that the child drew a quantity of laudanum into its mouth, sufficient to destroy life. (Med. Times and Gaz. Jan. 19, 1861, p. 70.) In some instances infants have been found to manifest an astonishing power of recovery. Dr. Guy met with a case in which an infant of six months recovered after having had administered to it ten grains of Dover's powder, equal to one grain of opium (Lancet, June 8, 1850); and Mr. Tubbs has informed me, that in a case which occurred in January 1852, an infant of nine months recovered under treatment from a dose of two teaspoonfuls of laudanum, given by mistake. This quantity left by evaporation four grains of an impure extract of opium. In 1860 a case was communicated to me in which an infant of between two and three months old, recovered after *five grains* of opium had been given to it by mistake for rhubarb. Dr. Hays met with a case in which a child not quite six years old, swallowed a powder containing *seven and a half grains* of opium mixed with powdered chalk. The child was not seen until fourteen hours afterwards. It was at first excited: there had been no vomiting. The narcotism was at no time very profound — it gradually subsided, and at the end of three days the child had recovered! (Am. Jour. Med. Sci. April 1859, p. 367.)

Period at which death takes place. — It has been remarked, that most cases of poisoning by opium prove fatal in from about six to twelve hours. They who recover from the stupor, and survive longer than this period, generally do well; but from cases above related (see p. 184), it would seem that there may be a partial recovery, or a remission of the symptoms, and afterwards a relapse. The symptoms, however, generally progress steadily to a fatal termination, or the stupor suddenly disappears, vomiting ensues, and the person recovers. Several instances are recorded of this poison having destroyed life in from seven to nine hours. One has occurred within my knowledge, in which an adult died in five hours after taking the drug prescribed for him by a quack. Dr. Christison met with a case which could not have lasted above five, and another is mentioned by him which lasted only three hours. Dr. Beck quotes a case which proved fatal in two hours and a half. (Beck. Med. Jour. p. 873.) Mr. Procter of York communicated to me the case of a female, æt. fifty, who, in January 1857, swallowed an ounce of laudanum of the pharmacopœial strength, and died from the effects in less than two hours. Opium was found in the stomach. The only appearance in the body was a congested state of the membranes of the brain. The most rapid case of death yet reported, was that of a soldier who was accidentally poisoned, in September, 1846, in the Hospital of Val-de-Grâce. It appears that he swallowed by mistake about an ounce of laudanum, and died in convulsions in *three-quarters of an hour.* (Journal de Médecine, Oct. 1846, p. 475. For a similar case, see Med. Gaz. vol. 45. p. 743.) It is possible that the drug may even kill with greater rapidity than this; but, as a medico-legal fact, we are at present entitled to state, that it has destroyed life within the short period above mentioned. On the other hand, the cases are sometimes much protracted. There are several instances of death in fifteen or seventeen hours. I have known one case fatal in twenty-two hours, and among those collected by Dr. Christison, the longest lasted twenty-four hours. (Op. cit. 712.)

POISONING BY POPPIES.

The heads of the white poppy grown in this country have a narcotic action. They yield an inspissated extract called English opium, which, according to Mr. Hennell, contains five per cent. of morphia. The white poppy-heads, therefore, yield to water, in the form of decoction, a poisonous substance capable of acting deleteriously on children. Many cases of poisoning have occurred from the injudicious use of *Syrup of poppies,* which is nothing more than a sweetened decoction of the poppy-heads. This syrup is said to contain *one grain* of extract (opium) to *one ounce* (Thomson). The common dose of it, for an infant three or four months old, is half a drachm; for adults, two to four drachms (Pereira, vol. 2. pt. 2. p. 643). There is some reason to believe that what is often sold by many druggists as syrup of poppies as a soothing or cordial medicine for children, is nothing more than a mixture of tincture or infusion of opium with simple syrup: it is therefore a preparation of variable strength. This may account for what appears to many persons inexplicable, namely, that an infant may be destroyed by a very small dose. In January, 1841, a child six months old is said to have died from the effects of less than half a teaspoonful of syrup of poppies bought at a retail druggist's. The narcotic symptoms were fully developed in three quarters of an hour. The syrup in this case probably contained tincture of opium. Several children are reported to have lost their lives by this syrup in 1837-8. In one of these instances a teaspoonful and a half was given. Stupor came on in half an hour, and the child died the following day. A teaspoonful has been known to prove fatal to a healthy child. (Pereira, vol. 2. Pt. 2. p. 644.)

Godfrey's Cordial.

This is chiefly a mixture of infusion of sassafras, treacle, and tincture of opium. The quantity of tincture of opium contained in it is stated by the late Dr. Paris to be one drachm in six ounces of the mixture, or *half a grain of opium to one ounce*: but it is probable that, like the so-called syrup of poppies, its strength is subject to great variation. A case has been reported, in which half a teaspoonful,= 1-32nd part of a grain of opium—was alleged to have caused the death of an infant. In 1837-8, twelve children were reported to have been killed by this mixture alone. The explanation of this is, that the medicine is given in large doses by very ignorant persons.

Dalby's Carminative.

This is a compound of several essential oils and aromatic tinctures in peppermint water, with carbonate of magnesia and tincture of opium. According to the late Dr. Paris there are *five minims* of the tincture, or one quarter of a grain of opium, in rather more than *two ounces* of this mixture, or *the one-eighth of a grain in an ounce.* The formula commonly given is — carbonate of magnesia two scruples, oil of peppermint one minim, of nutmegs two minims, of aniseed three minims, tincture of opium five minims, spirit of pennyroyal and tincture of assafœtida of each fifteen minims, tincture of castor and compound tincture of cardamoms of each thirty minims, and of peppermint water two ounces. According to this formula, tincture of opium forms the 1-211th part by measure, or one teaspoonful contains the 1-64th part of a grain of opium. Like most of these quack preparations, it varies in strength. An infant is reported to have been destroyed by *forty drops* of this nostrum — a quantity, according to the strength assigned, equivalent to more than *two minims* of the tincture, or from one-sixth to one-tenth of a grain, of opium. Accidents frequently occur from its use, partly owing to ignorance, and partly to gross carelessness on the part of mothers and nurses.

The quack preparation, known under the name of *Locock's pulmonic wafers*, contains opium. A boy, æt. four, suffered from all the usual symptoms of poisoning by opium as a result of eating a quantity of these wafers or lozenges. (Lancet, Oct. 27, 1860, p. 420.)

Paregoric Elixir. Compound Tincture of Camphor.

This is a medicinal preparation of alcohol, opium, benzoic acid, oil of aniseed and camphor. Opium is the active ingredient, and of this, the tincture contains rather less than *one* *grain* in every *half ounce* (nine grains to five ounces). In one case of poisoning by this tincture, a child aged seven months died from the effects of a teaspoonful (equal to one quarter of a grain of opium), given in two doses at an interval of a day. (Pharmaceutical Journal, April 1845.) In another an infant of five weeks recovered from a similar dose, although no treatment was resorted to for nine hours. (Med. Times and Gaz. Aug. 6, 1859, p. 145.) An infant has been killed by a dose equivalent to not more than the *ninetieth part* of a grain of opium (ante, p. 187).

DOVER'S POWDER. (PULV. IPECAC. COMP.)

This is a preparation of opium, the effects of which on young children have been already adverted to. The proportion of opium is one-tenth part, or *one grain* in every *ten grains* of the powder. A child has been killed by four grains; therefore by a quantity containing about two-fifths of a grain of opium. On the other hand, Mr. Ewens met with a case in which an infant of nine months recovered from a dose of five grains. (Med. Times and Gaz., May 19, 1860.) Dr. Guy has reported another, in which an infant of six months recovered, under active treatment, from a dose of ten grains. (Lancet, June 8, 1850.) And I am indebted for a still more remarkable instance of recovery to Mr. R. Read, of Dublin. Fifteen grains of Dover's powder were given to an infant under five months of age. The mistake was discovered immediately, and by active treatment the child recovered.

BLACK DROP.

This is a preparation of opium, in which the morphia is combined with acetic acid, and very little meconic acid is present. In the black drop, according to Pereira (Mat. Med. vol. 2. Pt. 2. p. 650), verjuice, the juice of the wild crab, is employed as a menstruum instead of vinegar. The black drop is considered to have from three to four times the strength of the tincture of opium. The formula for this preparation will be found in Dr. Neligan's work, On Medicines, &c., p. 235. According to this, it is a compound of half a pound of opium to three pints of the expressed juice of the wild crab. It resembles the *Acetum Opii*, and has more than twice the strength of laudanum.

SEDATIVE SOLUTION. (BATTLEY'S.)

This is an aqueous solution of opium holding a little spirit and less meconic acid than the common tincture. (Pereira, vol. 2. Pt. 2. p. 646.) It is considered to have three times the strength of tincture of opium; but there is so great a difference of opinion on this point, that Dr. Neligan represents it as being only of about the same strength as laudanum. (Medicines, &c., p. 236.) He states that it is composed of three ounces of extract of opium, six drachms of spirit, and as much distilled water as will make up two pints. It appears to be an energetic preparation. Mr. Streeter stated at the Westminster Medical Society, Dec. 1838, that he had known one drachm and a half of it prove fatal to a lunatic; and twenty minims of the solution destroyed the life of an old woman. A medical gentleman, lying dangerously ill from an attack of dysentery, took, by mistake, about seven drachms of Battley's solution. Within five minutes, salt and water, with mustard, were administered, and twenty-four grains of sulphate of zinc. Vomiting ensued; the emetic was repeated, and with the same effect: the fluid evacuated at the second vomiting having the usual smell of opium. Half a drachm of ipecacuanha was subsequently given to complete the emptying of the stomach. Notwithstanding repeated vomiting, symptoms of narcotism presented themselves speedily, with contraction of the pupils, and great drowsiness — rendering it necessary to remove the patient from bed in his debilitated state, and keep him constantly moving, until about 9 P.M. (seventeen hours), when vomiting came on spontaneously, and he was put to bed and allowed to sleep. The original disease afterwards resumed its course (complicated by an attack of gastritis), and at length terminated favourably: but the patient had no recollection whatever of what occurred for twenty-four hours after the administration of the emetics; and it appeared to his medical attendants that an excited state of mind remained for some days afterwards. (Prov. Journ., Jan. 28, 1846, p. 42.) The death of Dr. Badeley, of Chelmsford, from a dose of this solution taken medicinally, furnishes an additional proof of the dangerous uncertainty in the strength of this preparation.

Morphia and its Salts.

The two principal salts of morphia are the HYDROCHLORATE and the ACETATE.

Symptoms.—They generally *commence* in from *five* to *twenty minutes* after the dose of poison has been swallowed; and they closely resemble those observed in poisoning by opium. As a summary, it may be stated that they consist in dimness of sight, weakness and relaxation of the muscular system, tendency to sleep, stupor, loss of consciousness, coma, stertorous respiration, and more commonly than in poisoning by opium, there are convulsions. According to Orfila, in nineteen-twentieths of all cases the pupils will be found strongly contracted, a statement which I believe to be correct: the few exceptional cases were those in which the dose was excessive, and the symptoms were unusually violent. The state of the pupils gave rise to great difference of opinion among the medical witnesses on the trial of Dr. Castaing. (ON POISONS; 2nd ed. page 619.) The condition of the pulse varies greatly. In some cases there is great irritability, as well as itching of the skin, and irritability of the bladder with difficulty of passing urine. Vomiting and purging have been met with in those instances in which the dose was large.

Appearances.—The only appearance which can be referred to the action of morphia is fulness of the cerebral vessels, with occasionally serous effusion. These poisons have no local irritant action, and they therefore leave no marks of their operation in the stomach and bowels. An account of the appearances produced by an overdose of sulphate of morphia has been published by Orfila in a report of the case of *Dr. Ellenberger.* (Ann. d'Hyg. 1852, vol. 2. p. 359.) The case presents some curious features. The deceased imagined that he had discovered a certain antidote for morphia and its salts, and proposed, while Orfila was at Prague in October 1851, to swallow the poison and the antidote in his presence. Orfila consented to witness the experiment. A powder was produced, which was found to have a bitter taste, and to possess some of the chemical properties of morphia, evidently mixed, however, with some other substance. The Doctor swallowed about twenty-three grains of this powder, and immediately afterwards, his so-called antidote, which was a fine white powder having a sweetish taste. He did not suffer from any symptoms of poisoning. Orfila, with a keen eye to the practical use of antidotes, inquired whether he had ever allowed a certain interval to pass before taking the remedy. Dr. Ellenberger said that the results were the same. Six months after this experiment, Dr. Ellenberger died from a dose of about ten grains of sulphate of morphia. He had taken his antidote, but not until a considerable interval had elapsed. A minute inspection of the body was made, and the principal appearance was a well-marked congestion of the brain and its membranes. There were traces of sulphate of morphia in the stomach. The so-called antidote was examined, and found to consist of a mixture of magnesia and carbonate of magnesia.

Chemical analysis. Opium.—There are no means of detecting opium itself, either in its solid or liquid state, except by its smell and other physical properties, or by giving a portion of the suspected substance to animals, and observing the effects produced. The smell is said to be peculiar, but a similar smell is possessed by lactucarium, which contains neither meconic acid nor morphia. The *odour* is a good concomitant test of the presence of the drug, whether it be in a free state, or dissolved in alcohol or water, but it is not perceptible when the solution is much diluted. I found that half a grain of powdered opium, dissolved in half an ounce of water, lost its characteristic smell by a short exposure. The odour is decidedly volatile, and passes off when an opiate liquid is heated: it also escapes slowly at common temperatures. Again, it may be easily concealed by other odours, or the drug may undergo some change in the stomach during life which may destroy the odour. The analysis in cases of poisoning by opium is therefore limited to the detection of morphia and meconic acid.

Morphia.—Morphia is known by the following properties:—1. It crystallizes in fine prisms, which are white and perfect, according to their degree of purity. 2. When heated on platina, the crystals melt, become dark-coloured, and burn like a resin with a yellow smoky flame, leaving a carbonaceous residue. If this experiment be performed in a small reduction-tube, it will be found, by employing test-paper, that ammonia is one of the products of decomposition. 3. It is scarcely soluble in cold water, as it requires 1000 parts to dissolve it: it is soluble in one hundred parts of boiling water, and the hot solution has a faint alkaline reaction. By its insolubility in water it is readily known from its salts. It is not very soluble in ether, thus differing from narcotina; but it is dissolved by forty parts of cold, and rather less than this quantity of boiling alcohol. It is soluble in oils and in the caustic alkalies (potash). 4. It is easily dissolved by a very small quantity of all diluted acids, mineral and vegetable. 5. It has a bitter taste.

Tests.—In order to apply the chemical tests for morphia, the alkaloid may be dissolved in a few drops of a diluted acid, either the acetic or the hydrochloric. If the hydrochlorate or the acetate of morphia be presented for analysis, the salt may be at once dissolved in a small quantity of boiling water. The tests for this alkaloid are the following: 1. *Nitric acid.* This, when added to a moderately strong solution of a salt of morphia, produces slowly a deep orange-red colour. If added to the crystals of morphia or its salts, deutoxide of nitrogen is evolved:—the morphia becomes entirely dissolved, and the solution acquires instantly the deep red colour above described,—becoming, however, lighter by standing. In order that this effect should follow, the solution of morphia must not be too much diluted, and the acid must be added in pretty large quantity. The colour is rendered much lighter by boiling: therefore the test should never be added to a hot solution. 2. *Perchloride of iron* (sesquichloride), or colourless persulphate. Either of these solutions, when saturated and neutralized (by a small quantity of potash if necessary), produces an inky-blue colour in a solution of morphia. If the quantity of morphia be small, or the test has a deep red or yellow tint, the colour is greenish. The blue colour is entirely destroyed by acids,—is also destroyed by heat: thus the iron-test should never be employed with a very acid or a very hot solution of a salt of morphia. It may be observed, that the blue given by the test in a solution of morphia is entirely destroyed by nitric acid and replaced by an orange red colour, so that the nitric acid will act through the iron-test, but not vice versâ. In this way two tests may be applied to one quantity of liquid. 3. *Iodic acid.* Morphia in the solid state or in solution decomposes this acid, taking part of its oxygen, and setting free iodine. In order to make this evident, the iodic acid should be first mixed with starch; and a part of this mixture only, added to the suspected solution,—part being reserved, to allow of a comparison. (If the iodic acid be added to a solution of morphia without starch, the liquid becomes brown, and smells of iodine.) When the quantity is very small, there is only a reddish or purple tint slowly produced:—when large, the dark-blue iodide of farina is formed in a few seconds. The colour being destroyed by heat, the test must not be added to a hot solution. The test succeeds equally well with morphia or its salts, when unmixed with organic matter; but the analyst must remember, that the blue iodide of farina forms a colourless combination with a large quantity of starch: hence but little of this substance should be used, if the quantity of morphia be small. 4. *Sulphuric acid* and *bichromate of potash.* When strong sulphuric acid is poured on pure morphia in a solid state, there is either no effect, or the alkaloid acquires a light pinkish colour. On adding to this a drop of solution of bichromate of potash, or a small fragment of a crystal, it immediately becomes green (from oxide of chromium), and retains this colour for some time. Other alkaloids (strychnia) are not thus affected. Narcotina is turned of a bright yellow by sulphuric acid; therefore, although it becomes green when mixed with bichromate of potash, it could not be mistaken for morphia: besides, the green rapidly passes to a dingy brown colour.

Meconic acid.—This is a solid crystalline acid, seen commonly in scaly crystals of a reddish colour. It is combined with morphia in opium, of which, according to Mulder, it forms on an average six per cent. (Brande's Chemistry, vol. 2. p. 1403); and it serves to render that alkaloid soluble in water and other menstrua. *Tests.*—Many tests have been proposed for meconic acid; there is only one upon which any reliance can be placed, namely, the *Perchloride* or *Persulphate of iron.* This test gives, even in a diluted solution of meconic acid, a deep red colour; and it is owing to the presence of this acid that a salt of iron causes a deep red colour in tincture and infusion of opium, as well as in all liquids containing traces of meconate of morphia, the effects of the iron-test with morphia being counteracted by the presence of meconic acid. The red colour of the meconate of iron is not easily destroyed by diluted mineral acids, by a solution of corrosive sublimate, or by chloride of gold, but it is by sulphurous acid and chloride of tin. In liquids containing tannic acid, *e. g.* tea or beer, the action of this test is obscured.

Detection of opium in organic mixtures.—Opium itself may be regarded as an organic solid, containing the poisonous salt which we wish to extract. It is not often that, in fatal cases of poisoning by opium or its tincture, even when these are taken in large quantity and death is speedy, we can succeed in detecting meconate of morphia in the stomach. It is probably removed by vomiting, digestion, or absorption. If the matter be solid, it should be cut into small slices: if liquid, evaporated to an extract; and in either case, digested with distilled water and a small quantity of acetic acid for one or two hours at a gentle heat. The aqueous solution should be filtered, some acetic acid added, and then treated with acetate of lead, until there is no further precipitation. The liquid should be boiled and filtered: meconate of lead is left on the filter, while any morphia passes through under the form of acetate. The surplus acetate of lead contained in the filtered liquid (containing the morphia) should now be precipitated by a current of sulphuretted hydrogen—the sulphuret of lead separated by filtration, and the liquid evaporated at a very gentle heat to an extract, so that any sulphuretted hydrogen may be entirely expelled. On treating this extract with alcohol, the acetate of morphia, if present in sufficient quantity, may be dissolved out and tested. The *meconate* of lead left on the filter may be decomposed by boiling it with a small quantity of diluted sulphuric acid: and in the filtered liquid, neutralized if necessary by an alkali, the meconic acid is easily detected by the iron-test. This analysis requires care as well as some practice in the operator, in order that the morphia should be obtained in a sufficiently pure state for the application of the tests. Before resorting to this process, it is advisable to employ *trial tests* on the original liquid, in order to determine whether any meconic acid or morphia is present or not. The smell of opium may be entirely absent. The best trial tests are nitric acid and the permuriate of iron. These will produce in the infusion or liquid, if it contain opium, the changes already indicated. In testing for meconic acid, it is advisable to dilute the organic liquid, if coloured, with a sufficient quantity of water to render the production of a change of colour by the test perceptible. In respect to this method of detecting the meconate of morphia in a suspected liquid, it is proper to observe, that nitric acid will indicate the presence of morphia, and chloride of iron the presence of meconic acid, in infusions containing so small a quantity of opium as not to be precipitated by the acetate of lead. The chief difficulty in the detection of morphia is that the alkaloid does not form more than one-tenth part of opium, and the quantity of opium present in an organic liquid is generally very small.

CHAPTER 19.

PRUSSIC ACID—DIFFERENCES IN STRENGTH—TASTE AND ODOUR—CONDITIONS UNDER WHICH THE ODOUR MAY AND MAY NOT BE DETECTED—SYMPTOMS PRODUCED BY SMALL AND LARGE DOSES—PERIOD AT WHICH THE SYMPTOMS COMMENCE—POWER OF VOLITION AND LOCOMOTION—APPEARANCES—QUANTITY REQUIRED TO DESTROY LIFE—FATAL DOSE—PERIOD AT WHICH DEATH TAKES PLACE—TESTS FOR THE ACID—VAPOUR TESTS—PROCESS FOR ORGANIC MIXTURES. BITTER ALMONDS. NOYAU. CYANIDE OF POTASSIUM.

Symptoms. — The acid has a hot bitter taste and an odour resembling that of bitter almonds diluted. The time at which the symptoms of poisoning commence in the human subject, is liable to great variation from circumstances not well understood. When a large dose has been taken, as from half an ounce to an ounce of the diluted acid, the symptoms usually commence in the act of swallowing, or within a few seconds. It is rare that their appearance is delayed beyond *one or two minutes.* When the patient has been seen at this period, he has been perfectly insensible, the eyes fixed and glistening, the pupils dilated and unaffected by light, the limbs flaccid, the skin cold and covered with a clammy perspiration; — there is convulsive respiration at long intervals, and the patient appears dead in the intermediate time; the pulse is imperceptible, and involuntary evacuations are occasionally passed. The respiration is slow, deep, gasping, and sometimes heaving, or sobbing. The following case was communicated to me by Mr. French: it presents a fair example of the effects of this poison in a large and fatal dose. A medical man swallowed seven drachms of the common prussic acid. He survived about four or five minutes, but was quite insensible when discovered, *i.e.* about two minutes after he had taken the poison. He was found lying on the floor senseless, — there were no convulsions of the limbs or trunk, but a faint flickering motion was observed about the muscles of the lips. The process of respiration appeared to cease entirely for some seconds: it was then performed in convulsive fits, and the act of expiration was remarkably deep, and lasted for a very long time. When the dose is large, the breath commonly exhales a strong odour of the acid, and this is also perceptible in the room. Convulsions of the limbs and trunk, with spasmodic closure of the jaws, are usually met with among the symptoms; the finger-nails have been found of a livid colour, and the hands firmly clenched. The breathing is generally convulsive, but when the coma or insensibility is profound, it is sometimes *stertorous*. This was noticed in a case which occurred to Dr. Christison (Edinburgh Monthly Journal, February, 1850, p. 97). It was also observed in the case of *Marcooley* (*Reg.* v. *Boroughs*, C.C.C., February, 1857). Stertorous breathing has not been hitherto recorded by toxicologists as one of the symptoms of poisoning by prussic acid. In the inquiry which took place at Rugeley, in January 1856, respecting the death of *Walter Palmer*, it was contended that the fact of the deceased having had stertorous breathing was a proof that he had died from apoplexy, and not, as it was alleged, from prussic acid; but the facts here recorded show that such an inference is erroneous.

When a small dose (*i. e.* about thirty minims of a weak acid) has been taken, the individual has first experienced weight and pain in the head, with confusion of intellect, giddiness, nausea, a quick pulse, and loss of muscular power: these symptoms are, however, sometimes slow in appearing. Vomiting has been occasionally observed, but it is more common to find foaming at the mouth, with suffusion or a bloated appearance of the face, and prominence of the eyes. If death result, this is preceded by tetanic spasms, opisthotonos, and involuntary evacuations. Vomiting is sometimes the precursor of recovery. (See cases in Medical Gazette, vol. 36, p. 103; vol. 35, pp. 859, 893.) A case which occurred to Mr. Bishop (Prov. Med. and Surg. Jour. Aug. 13, 1845, p. 517) was remarkable in several particulars: the individual swallowed, it was supposed, forty minims of an acid (at three and a quarter per cent.), and was able to give an account of his symptoms. He was conscious for some time after he had taken it, and he recollected experiencing the sensation of his jaws becoming gradually stiff and tight. One of the most marked effects of prussic acid is to produce insensibility, and loss of muscular power, much more speedily than any other poison. In some instances, there may be loss of consciousness in a *few seconds*; in others, certain acts indicative of volition and locomotion may be performed, although requiring for their performance several *minutes*.

Appearances.—The body when seen soon after death often exhales the odour of prussic acid; but if it has remained exposed before it is seen, and especially if it has been exposed to the open air or in a shower of rain, the odour may not be perceptible; again the odour may be concealed by tobacco-smoke.

peppermint, or other powerful odours. In a case in which a person poisoned himself with two ounces of the acid, and his body was examined twenty-eight hours after death, the vapour of prussic acid which escaped on opening the stomach, was so powerful that the inspectors were seized with dizziness. In cases of suicide or accident, the vessel out of which the poison has been taken will commonly be found near; but there is nothing to preclude the possibility of a person throwing it from him in the last act of life, or even concealing it, if the symptoms should be delayed. (See *post*, case by Dr. Christison, page 201.) Owing to the great volatility of the poison, the vessel may, if left uncorked, not retain the odour when found. Putrefaction is said to be accelerated in these cases; but from what I have been able to collect, there seems to be no ground for this opinion. (See case in Prov. Med. Journ. July 30, 1845.) *Externally*, the skin is commonly livid, or is tinged of a violet colour; the nails are blue, the fingers clenched, and the toes contracted; the jaws firmly closed, with foam or froth about the mouth, the face often pallid, but sometimes bloated and swollen, and the eyes have been observed to be wide open, fixed, glassy, very prominent and glistening, and the pupils dilated: but this condition of the eyes has been observed in other kinds of death. *Internally*, the venous system is gorged with dark-coloured liquid blood: the *stomach* and alimentary canal may be in their natural state; but in several instances they have been found more or less congested. The mucous membrane of the stomach of a dog which died in a few minutes from a dose of three drachms of Scheele's acid, was intensely reddened throughout, presenting the appearance met with in cases of arsenical poisoning. In a large number of experiments upon dogs, Mr. Nunneley states that he found generally a congested condition of the mucous membrane of the stomach: if empty at the time the poison was taken, the organ was found much contracted, and of a brick-red colour. This appearance of congestion was observed on the mucous membrane of the vagina, the rectum, and conjunctiva, when the acid was applied to these parts. (Prov. Trans. N.S. vol. 3. p. 79.) Redness of the stomach was noticed in the case of the Parisian epileptics (Annales d'Hygiène, 1829, vol. 1. p. 507). Dr. Geoghegan, of Dublin, has communicated to me the particulars of a case in which this redness of the mucous membrane was well marked. In April 1847, a healthy man, æt. thirty, swallowed a large dose of prussic acid. He was soon afterwards found dead in his bed. The body was inspected five hours afterwards: rigidity had commenced, but there was some warmth. The face was pale, the eyes were half closed, not presenting any remarkable brilliancy or prominence, and there was great dilatation of the pupils. The mouth was closed, and no froth issued from it. The abdomen was the only cavity examined. The muscles were red, and gave out, on section, a good deal of fluid blood, which had a strong odour of prussic acid; the odour of the poison was also perceptible in the abdomen. About eight ounces of a thick farinaceous mass were found in the stomach: the odour of prussic acid was very perceptible in this organ, but it was mixed with that of rancid food. The mucous membrane had everywhere, except at the greater end and posterior wall, a vivid inflammatory redness, of a well-marked character, and it was covered with a layer of viscid mucus to a considerable extent. The mucous membrane, even when washed three times in water, gave out a strong odour of prussic acid. In a case which I examined in May 1850, in which death had been caused by a large dose of the acid, there was a generally congested state of the mucous membrane of the stomach. I am indebted to Mr. Blaker, of Lewes, for an account of the appearances found in the body of a medical student who destroyed himself in March 1860, by swallowing about one drachm of Scheele's acid. He was found in a state of collapse, and breathing heavily in about half a minute from the time at which he was last seen. He died in twenty minutes. The coats of the stomach were greatly congested towards the cardiac end. The minute vessels throughout were filled with dark blood, and there were some spots of effused blood beneath the mucous coat. The intestines were highly congested, the small vessels being visible all over the coats. There was no congestion of the membranes of the brain.

Quantity required to destroy life.—The *smallest* dose of this acid which is reported to have caused death, was in a case which occurred to Mr. Hicks. (Med. Gaz. vol. 35. p. 896.) The female, a healthy adult, died in twenty minutes from a dose equivalent to *nine-tenths* of a grain of anhydrous prussic acid. This was equivalent to *forty-nine grains* of the London Pharmacopœial acid; and taking Scheele's acid at five per cent., to about *twenty grains* of this acid. In a case reported by Mr. T. Taylor (Med. Gaz. vol. 36. p. 104), a stout healthy man swallowed this dose, *i.e.* nine-tenths of a grain, by mistake, and remained insensible for *four hours*, when he vomited and began to recover. The vomited matters had *no odour* of the poison, showing that if not concealed by other odours the whole of the acid must have been here absorbed. He had a very narrow escape of his life. Dr. Banks has published a case in which a female recovered after swallowing thirty drops of prussic acid (Ed. Med. and Surg. Jour. vol. 48. p. 44.) The *largest* dose from which an adult has recovered, was probably in a case which has been reported by Mr. Burman, (Lancet, Jan. 14, 1854). His father, æt. sixty, of a strong constitution, took by mistake a *drachm* of prussic acid, equivalent to 2·4 grains of anhydrous acid. In a few seconds he perceived the mistake, and swallowed half an ounce of aromatic spirits of ammonia with a little water. Four minutes after taking the poison cold affusion was employed, and sulphate of iron and spirits of ammonia administered. Vomiting with convulsive shuddering took place. In twenty minutes consciousness returned, and fifteen minutes later he was able to walk up stairs to bed. He perfectly recovered, but in the absence of the treatment resorted to, it is most probable that he would have died. Dr. Christison has reported in the Edinburgh Monthly Journal (Feb. 1850, p. 97) the case of an adult who recovered after having taken a dose of a *grain and a half* or two grains of anhydrous acid. The treatment consisted in the evacuation of the stomach by the stomach-pump, and in pouring a current of cold water on the head. The symptoms were such that the man would have died, but for immediate treatment. It is a remarkable fact that in this case no bottle or vessel could be found in the room or under the window. The patient hastily summoned his wife one evening, told her that he had taken prussic acid, and immediately fell down senseless on a sofa, without either cry or convulsion, but drawing his breath deeply, forcibly, and slowly. He recovered in about three hours, but had an unusual disposition to sleep even on the following day. Another remarkable case of recovery from a dose nearly as large occurred to Mr. Bishop. (Prov. Med. Jour. Aug. 13, 1845, p. 517.) From the facts hitherto observed, we shall not be wrong in assuming that a quantity of Scheele's acid (at five per cent.) *above twenty grains* (i. e. *one grain of anhydrous acid*), or an equivalent portion of any other acid, would commonly suffice to destroy the life of an adult. This I believe to be the nearest approach that we can make to the *smallest fatal dose*. In *Reg.* v. *Bull*, tried at Lewes Aut. Assizes 1860, a question arose respecting the minimum fatal dose of this poison. The accused, a young medical man, was charged with the manslaughter of his mother, a woman æt. sixty-six. He had prescribed prussic acid for her to relieve sickness. He procured a bottle of Scheele's acid, said to contain one drachm. He administered four minims to deceased in the morning, and it appeared to benefit her. In the evening he gave to her another dose amounting, according to his statement, to "seven drops." The deceased went up stairs, became insensible, and died in a few minutes. When the bottle was examined twenty-five minims remained in it: hence thirty-five minims were alleged to be missing, but the druggist who sold the acid poured out the quantity conjecturally and the bottle was found to have a broken cork. The strength of the acid had not been determined. Under these circumstances the prisoner was acquitted. In this case the Court desired to know the relation of drops to minims; but no satisfactory answer could be given. A drop of water is considered to be equal to a grain in weight or a minim by measure; but the size of a drop materially depends on the nature of the liquid and the rapidity of the measurement. Seven drops of Scheele's acid dropped from a small phial measured seven minims. There can be no doubt in the above case that the poison caused death, and unless we assume that seven drops or minims will destroy life, which is not probable, the deceased must have taken a much larger dose than the prisoner had intended.

Period at which death takes place.—When the dose is two drachms and upwards, we may probably take the average period for death at from *two* to *ten minutes*. In Mr. Hicks's case, forty-nine grains of the Pharmacopœial acid destroyed life in twenty minutes. It is only when the dose is just in a fatal proportion, that we find the individual to survive from half an hour to an hour. In this respect, death by prussic acid is like death by lightning,—the person in general either dies speedily or recovers altogether. According to Dr. Lonsdale, death has occurred in the human subject as early as the *second*, and as late as the *forty-fifth* minute. But although death does not commonly ensue until after the lapse of a few minutes, insensibility, and consequently a want of power to perform acts of volition and locomotion, may come on sometimes in a few seconds. The time at which this loss of muscular power is supposed to take place, has frequently become an important medico-legal question: and on the answer to it the hypothesis of suicide or murder in a particular case may rest.

Chemical analysis.—Prussic acid is limpid like water: it possesses a faint acid reaction, and its vapour has a peculiar odour, which, when the acid is concentrated, although not at first perceptible, is sufficient to produce giddiness, insensibility, and other alarming symptoms. The tests which are best adapted for the detection of this poison, either in liquid or vapour, are equally applicable whether the acid is concentrated or diluted, and, so far as the detection of the *vapour* is concerned, whether the acid is pure or mixed with organic matter. *In the simple state*, the tests are three in number:—the *Silver*, the *Iron*, and the *Sulphur* tests.

1. *The Silver Test.*—*Nitrate of Silver.*—This yields, with prussic acid, a dense white precipitate, speedily subsiding in heavy clots to the bottom of the vessel, and leaving the liquid almost clear. The precipitate is identified as cyanide of silver by the following properties:—*a.* It is insoluble in cold nitric acid; but when drained of water, and a sufficient quantity of strong acid is added, it is easily dissolved on boiling. *b.* It evolves prussic acid when digested in muriatic acid. *c.* The precipitate, when *well dried* and heated in a small reduction-tube, yields cyanogen gas, which may be burnt as it issues,

producing a rose-red flame and blue halo. This is a well-marked character, and at once identifies the acid which yielded the precipitate as prussic acid. By this property, the cyanide is eminently distinguished from all the other salts of silver. In the employment of the silver-test for the detection of the *vapour* of the poison, we place a few drops of the silver solution in a watch-glass, and invert it over another watch-glass containing the suspected poisonous liquid. Cyanide of silver, indicated by the formation of an opaque white film in the solution, is immediately produced, if the acid be only in a moderate state of concentration. One drop of the pharmacopœial acid (containing less than the 1-50th of a grain) produces speedily a visible effect. When the prussic acid is much diluted, a few minutes are required; and the opaque film begins to show itself at the edges of the silver solution. In this case the action may be accelerated by the heat of the hand.

2. *The Iron-Test.*—The object of the application of this test is the production of *Prussian Blue.* We add to a small quantity of the suspected poisonous liquid, a few drops of potash and of a solution of green sulphate of iron. A dirty green or brownish precipitate falls; on shaking this for a few minutes, and then adding diluted hydrochloric or sulphuric acid, the liquid becomes blue; and Prussian blue, of its well-known colour, unaffected by diluted acids, subsides. If the prussic acid is in small quantity, the liquid is at first yellow, from the salt of iron formed; it then becomes green, but the precipitate ultimately subsides so as to appear of a blue colour in the mass. The same result is obtained by adding the solution of the iron-salt to the potash-solution of the cyanide of silver; and thus, in this way, the two tests may be applied to only *one* portion of the poison. The iron-test may be employed for the detection of the *vapour* of prussic acid, by the same method as that described in speaking of the silver-test. For this purpose we place a few drops of caustic potash in a small white saucer, and invert it over the suspected liquid. After a few minutes a drop of solution of green sulphate of iron may be added, and then a drop of diluted hydrochloric acid,—when Prussian blue will appear. The recently precipitated mixed oxides of iron with potash, may be placed in the upper vessel with the same results. The silver and the iron-tests may be easily conjoined in testing the same quantity of poison. If the precipitated cyanide of silver, obtained by the addition of nitrate of silver to the suspected liquid, be moistened with strong hydrochloric acid, and the vapour collected in a watch-glass or saucer, on the plan just described, Prussian blue will be procured, and thus strongly corroborate the action of the silver-test.

3. *The Sulphur-Test.*—Liebig has proposed the following process for detecting prussic acid as a *liquid.* (Oesterreich-

ische Med. Wochenschrift, 27 März, 1847, p. 396.) If a small quantity of hydrosulphate of ammonia (containing a little excess of sulphur) be added to a few drops of a solution of prussic acid, and the mixture be gently warmed, it becomes colourless, and, on evaporation, leaves sulphocyanate of ammonia — the sulphocyanic acid being indicated by the intense blood-red colour produced on adding to the dry residue a solution of a persalt of iron: this colour immediately disappears on adding a few drops of a solution of corrosive sublimate. The intensity of the colour is also destroyed by moderate dilution with water. This process is very delicate, and it therefore requires some care in its application: thus, if the boiling and evaporation be not carried far enough, the persalt of iron will be precipitated black by the undecomposed hydrosulphate of ammonia: and, if the heat be carried too far, the sulphocyanate of ammonia may itself undergo decomposition, and be lost. It will be perceived, too, that it requires a longer time for its application than either the silver or the iron-test. If the prussic acid contains traces of Prussian blue or a salt of iron, it will acquire a dark colour on the addition of hydrosulphate of ammonia.

The great utility of the *sulphur-test*, however, is in its application to the detection of the minutest portion of prussic acid when in the state of *vapour*. In this respect it surpasses any other process yet discovered. In order to apply it, we place the diluted prussic acid in a watch-glass, and invert over it another watch-glass, holding in its centre one drop of the hydrosulphate of ammonia. No change apparently takes place in the hydrosulphate; but if the watch-glass be removed after the lapse of from half a minute to ten minutes, according to the quantity and strength of prussic acid present, sulphocyanate of ammonia will be obtained on gently heating the drop of hydrosulphate and evaporating it to dryness. With an acid of from three to five per cent. the action is completed in ten seconds. The addition of one drop of the persulphate of iron to the dried residue brings out the blood-red colour instantly, which is intense in proportion to the quantity of sulphocyanate present. Such is the simple method of employing the test. When the prussic acid is much diluted, the warmth of the hand may serve to expedite the evolution of the vapour. I have elsewhere made some remarks on the application of this process for the detection of prussic acid. (See Med. Gaz. vol. 39. p. 765.)

Prussic Acid in Organic Liquids. Detection by vapour without distillation. — The organic liquid may be placed in a wide-mouthed bottle, to which a watch-glass has been previously fitted as a cover. The capacity of the bottle may be such as to allow the surface of the liquid to be within one or two inches of the concave surface of the watch-glass. The solution of *Nitrate of silver* is then used as a trial-test in the way already described. If the 1-200th of a grain of prussic acid be present, and not too largely diluted, it will be detected (at a temperature of 60°) by the drop of nitrate of silver being converted into an opaque white film of cyanide of silver, the chemical change commencing at the margin. We may then substitute for the nitrate of silver the hydrosulphate of ammonia, and proceed in the manner above described. It may be sometimes necessary to place the bottle in a basin of warm water. If the solution of silver is tarnished by sulphuretted hydrogen—the sulphur-test alone can be used. By this process I have detected prussic acid in the stomach of a person poisoned by it, as late as twelve days after death. After the stomach had been exposed for a few days longer, all traces of the poison had disappeared.

Detection by distillation.—This process was originally suggested by Lassaigne. The organic liquid should be distilled in a water-bath, at 212°, and about one-sixth or one-eighth of the contents of the retort collected in a receiver kept cool by water. The tests may now be applied to the distilled liquid. If the trial-tests indicate that the quantity of poison is small, a solution of nitrate of silver or caustic potash may be placed in the receiver, to fix the acid as it is distilled over; Prussian blue may then be procured in the manner described, or the vapour may be at once absorbed by hydrosulphate of ammonia in the receiver, and the liquid evaporated to obtain sulphocyanate. Prussic acid has been found in the stomach by *distillation*, so late as *seven* days after death, although the odour could not be perceived before distillation. In the case of *Montgomery* (Report of trial of Thompson, Glasgow Circuit Court, 1857, by Hugh Cowan, pp. 9 and 53), the deceased died in about fifty minutes after having taken two drachms of prussic acid (three and a quarter grains of anhydrous acid). The death took place on the 13th September: the body was buried on the 17th, and exhumed on the 30th. The parts removed were then put into stoppered bottles, and on the 5th of October the Drs. McKinlay detected prussic acid doubtfully by the odour, but distinctly by the three tests, in the stomach, before distillation, as well as in the liquid distilled from the stomach and its contents. They did not succeed in detecting its presence in the tissues. About five weeks subsequently to this analysis, the viscera, which had been kept closely secured in glass bottles, were examined by Dr. Maclagan. The heart, kidneys, and intestines gave no indication of the presence of the poison, but it was detected by the sulphur-test, in the form of vapour, in one half of the spleen, although there was no odour of the poison. When the viscera containing the poison have undergone putrefaction no trace of the acid may be found either by its vapour or by distillation. In this case it may have been converted into sulphocyanate of ammonia by the hydrosulphate produced during putrefaction. The sulphocyanide may be dissolved out of the dried viscera or liquids by alcohol, and the solution tested by a persalt of iron. Much is lost by reason of the great volatility of the acid. I have found the vapour to traverse wet and dry bladder in a few minutes. Hence all viscera suspected to contain prussic acid, should be preserved in well-stoppered bottles.

In the tissues.—Soon after death the poison may be easily detected in the blood, secretions, or any of the soft organs, by placing them in a bottle, and collecting the vapour in the manner already described. This will be found to be far more convenient and satisfactory than the process by distillation. In the case of a dog poisoned by a large dose of prussic acid, Mr. Hicks brought to me the stomach after it had been exposed twenty-four hours, and thoroughly washed under a current of water, and yet the poison was readily detected by placing the whole organ in a bottle, and absorbing the vapour by nitrate of silver. This shows how completely the animal tissues at death are penetrated by prussic acid, and how firmly for a time it is retained by them. The poison has been thus discovered, in experiments on animals, in the blood and in the serous exhalation of the chest.

CHAPTER 20.

NUX VOMICA AND STRYCHNIA—SYMPTOMS—APPEARANCES AFTER DEATH—FATAL DOSE—EFFECTS OF MEDICINAL DOSES OF STRYCHNIA—PERIOD AT WHICH DEATH TAKES PLACE—CHEMICAL ANALYSIS.

NUX VOMICA. STRYCHNIA.

Symptoms.—Nux Vomica, in powder, is a poison which is frequently taken by suicides. Its intensely bitter taste in a quantity far from dangerous to life, renders it difficult to administer it unknowingly. With respect to *Strychnia*, it has acquired, within the last few years, great notoriety as a poison. It has an intensely bitter taste when dissolved, but when administered in the form of pills, this of course would not be perceived. At a variable interval, after taking either nux vomica or strychnia, the patient experiences a sense of impending suffocation. There are twitchings and jerkings of the head and limbs,—with a shuddering or trembling of the whole frame. Tetanic convulsions then commence suddenly with great violence, and nearly all the muscles of the body are simultaneously affected. The limbs are stretched out, the hands clenched—the head, after some convulsive jerkings, is bent backwards, the whole body is as stiff as a board,—and assumes, by increase of the convulsions, a bow-like form (opisthotonos), being arched in the back and resting on the head and heels. The head is firmly bent backwards, and the soles of the feet are incurvated or arched and everted, the legs sometimes separated. The abdomen is hard and tense—the chest spasmodically fixed—so that respiration appears to be arrested—the face assumes a dusky or congested appearance, with a drawn, wild or anxious aspect, the eyeballs are prominent and staring, and the lips are livid. The intellect is clear, and the sufferings, during this violent spasm of the voluntary muscles, are severe. The patient in vain seeks for relief in gasping for air and in requiring to be turned over, moved or held. With respect to the muscles of the lower jaw—these, which are the first to be affected in tetanus from disease, are generally the last to be affected by the poison. The jaw is not primarily attacked, and is not always fixed during the paroxysm. The patient can frequently speak and swallow, and great thirst has been observed among the symptoms. In some cases of poisoning by nux vomica the jaw has been fixed by muscular spasm; but, unlike the lock-jaw of disease, this has come on suddenly in full intensity, with tetanic spasms in other parts, and there have been intermissions which are not witnessed in the tetanus of disease. The sudden and universal convulsion affecting the voluntary muscles has sometimes been so violent that the patient has been jerked off the bed. After an interval of half a minute to one or two minutes, the convulsions subside, there is an intermission — the patient feels exhausted and is sometimes bathed with perspiration. It has been noticed in some of these cases that the pupils during the paroxysm were dilated, while in the intermission they were contracted. The pulse during the spasms is so quick that it can scarcely be counted. Slight causes, such as the attempt to move, a sudden disturbance, or touching the patient, will frequently bring on a recurrence of the convulsions. In cases likely to prove fatal, they rapidly succeed each other and increase in severity and duration until at length the patient dies exhausted. The tetanic symptoms produced by strychnia, when once clearly established, progress rapidly to death or recovery. The duration of the case, when the symptoms have set in, is reckoned by minutes, while in the tetanus of disease, when fatal, it is reckoned by hours, days, and even weeks. As a general statement of the course of these cases of poisoning,—within *two hours* from the commencement of the symptoms the person either dies or recovers, according to the severity of the paroxysms and the strength of his constitution.

The *time at which the symptoms commence* appears from the recorded cases to be subject to great variation. In poisoning by Nux Vomica the symptoms are generally more slow in appearing than in poisoning by strychnia. Until they set in suddenly, the patient is capable of walking, talking, and going through his or her usual occupations. In a case which occurred to M. Pellarin, a man swallowed about 300 grains of nux vomica and no symptoms appeared for two hours. He died speedily in a violent convulsive fit. (Ann. d'Hyg. 1861, vol. 2, p. 431.) On an average in poisoning by strychnia the symptoms appear in from five to twenty minutes. In two cases at least an hour has elapsed. (Lancet, August 31, 1850. On Poisoning by Strychnia, 1856, p. 139.) In a case which occurred to Drs. Lawrie and Cowan in June 1853, an hour and a half elapsed. The longest interval recorded was in a case which occurred to Dr. Anderson in 1848, in which *two hours and a half* elapsed before the appearance of symptoms. (Poisoning by Strychnia, p. 42.) In spite of these facts, an attempt was made in the medical defence of Palmer to mislead the jury by the assertion that an interval of *an hour and a quarter* in the case of *Cook* rendered it impossible that the symptoms could have been caused by strychnia! (*Reg.* v. *Palmer*, C.C.C. May, 1856.)

Appearances after death.—The body is commonly observed to be relaxed at the time of death, but speedily stiffens and retains an unusual rigidity for a long period. In the case of *Cook*, who was poisoned by *William Palmer*, the rigidity of the limbs, including the hands and feet, was still well marked on exhumation, after two months' interment. In most cases the hands are clenched,—and the feet arched, or turned inwards. Among the internal appearances are—congestion of the membranes and substance of the brain,—as also of the upper part of the spinal marrow—congestion of the lungs—the heart is contracted and empty: but its right cavities in other instances are distended with liquid blood. The blood has been found black and liquid throughout the body. The mucous membrane of the stomach has occasionally presented patches of congestion, probably depending on extraneous causes: since in other instances the stomach and intestines have been found quite healthy. Of the appearances produced in poisoning by strychnia, there are none which can be considered strictly characteristic. Congestion of the membranes of the brain and spinal marrow is probably the most common. In a case which occurred to Mr. Startin, a man who had taken strychnia medicinally, died in less than three hours from a dose of a grain and a half. On inspection, there were extensive patches of extravasated blood beneath the arachnoid membrane of the lower half of the spinal cord. (Med. Times and Gazette, March 21, 1857, p. 297.) With regard to the state of the heart and lungs, their condition as to fulness or emptiness must depend rather on the mode of dying, than on the actual cause producing death.

Quantity required to destroy life.—The *sixteenth part of a grain* of strychnia killed a child between two and three years of age in four hours. In two cases of adults, in each of which a quarter of a grain had been taken by mistake, the patients only recovered under early treatment. (Lancet, July 26, 1856, pp. 107, 117.) The smallest fatal dose in an adult was in the case of *Dr. Warner*. *Half a grain* of the sulphate of strychnia here destroyed life. (On Poisoning by Strychnia, pp. 138, 139.) So powerful are the effects of this drug in certain cases, that ordinary medicinal doses can scarcely be borne. A gentleman took one-twentieth of a grain of strychnia in six doses over a period of two or three days. Severe fits of tetanus occurred although half a grain had not been taken altogether. It is probable in such cases that elimination is either arrested or it is imperfectly performed. In May 1859, Dr. Tweedie informed me of a case in which he had prescribed for a gentleman pills containing 1-15th grain of strychnia. He took altogether five of them, or $\frac{1}{3}$rd of a grain at proper intervals. The patient was seized with the most alarming tetanic convulsions continuing for some time. There was also opisthotonos of a severe kind. He only slowly recovered.

Butler's *Vermin powder*, which is a mixture of strychnia with flour and Prussian blue or some other colouring material, has been and is a fertile source of poisoning either through accident or design. The quantity of strychnia is probably not uniform: but the sixpenny packet has been found to contain three grains:—the half packet contains from one to one grain and a half. In 1859 a man recovered after taking a whole packet (nearly three grains of strychnia). (Ed. Monthly Journal, 1859, vol. 2. p. 507.) In 1860 a case occurred to Dr. Part, in which a female recovered after having taken a half packet of this powder. Recovery in these cases was chiefly due to the vomiting excited by emetics. A case in which a drachm-packet of this powder destroyed the life of a girl, æt. seventeen, in about one hour, under the usual symptoms, is reported by Mr. Saville. (Med. Times and Gaz. November 1857.) There are at least three instances recorded in which persons have recovered after taking one grain, and in one instance a person is said to have recovered from a dose of seven grains of strychnia (Medical Gazette, vol. 41. p. 305). These, however, must be regarded as exceptional cases. A fatal dose of strychnia for an adult may be assigned at from *half a grain to two grains*.

With respect to *nux vomica*, three grains of the alcoholic extract have destroyed life. The smallest fatal dose of the powder was in a case reported by Hoffmann, and quoted by Christison (p. 901), also by Trail (Outlines, p. 137). *Thirty grains* of the powder, given in two doses of fifteen grains each, proved fatal. The poison was given by mistake for bark to a patient labouring under quartan fever. This is about equivalent to the weight of one full-sized seed. The dose required to destroy life became of some importance in *Reg.* v. *Wren* (Winchester Spring Assizes, 1851). The prisoner was convicted of an attempt to administer this poison in milk; the quantity separated from the milk amounted to forty-seven grains. The intense bitterness which the nux vomica gave to the milk led to detection, and this would, in general, be a bar to the criminal administration of this poison, except in the form of pills.

Period at which death takes place.—In fatal cases death generally takes place within two hours after the taking of the strychnia. One of the most rapidly fatal cases recorded is that of *Dr. Warner.* The symptoms commenced in five minutes, and he was dead in *twenty minutes.* In the case of *Cook,* the symptoms commenced in an hour and a quarter, and he died in *twenty minutes.* One of the longest cases for duration was communicated to me by Mr. Wilkins. The deceased, an adult, died in *six hours* from a dose of three grains of strychnia. (Guy's Hosp. Reports, Oct. 1857, p. 483.) In poisoning by *nux vomica,* death usually occurs within two hours; but Dr. Christison mentions a case in which a man died in *fifteen minutes* after taking a dose (p. 898). This is probably the shortest period known. There are several instances of recovery on record, even after large doses. Mr. Iliff has reported a case in which a female recovered after taking two drachms of this poison. (Lancet, Dec. 15, 1849.)

Chemical analysis.—*Nux vomica* is well known as a flat round kernel, about the size of a shilling, with radiating silken fibres, slightly raised in the centre. It is of a light brown colour, and covered with a fine silky down. It is very hard, brittle, tough, and difficult to pulverize. The powder is of a grey brown colour, like that of liquorice: it is sometimes met with in a coarsely rasped state: it has an intensely bitter taste. It yields to water and alcohol,—strychnia, brucia, igasuric or strychnic acid, and some common vegetable principles. Heated on platina foil, it burns with a smoky flame. Nitric acid turns it of a dark orange-red colour, which is destroyed by chloride of tin. In one case of poisoning by this substance (*Reg.* v. *Wren*) I found a quantity of guaiacum powder mixed with the nux vomica. This so completely changed the action of nitric acid as in the first instance to create some difficulty in identifying the substance. The analyst must be prepared for these admixtures or adulterations.

The aqueous *infusion* or *decoction* is reddened by nitric acid, and is freely precipitated by tincture of galls. Persulphate of iron gives with it an olive-green tint. These properties are sufficient to distinguish it from various medicinal powders which it resembles. The fine silky fibres which cover the surface of the kernel may be identified by the microscope. The powder, owing to its indigestible nature, and the rapidity with which it causes death, will generally be found in the stomach and bowels. If a sufficient portion should remain in the body, it may be collected, and strychnia extracted from it. The quantity of the alkaloid contained in it is, however, very small. It amounts to from a half to one per cent.

Strychnia. — This alkaloid crystallizes from its alcoholic solution in lengthened octahedra and in prisms of a peculiar form, some of which cross each other at an angle of 60°. 1. It is white, of an intensely bitter taste, even when it forms only 1-30,000th part of a solution. 2. When heated on platina, it melts and burns like a resin, with a black smoky flame. 3. It is not perceptibly dissolved by cold water: it requires 7000 parts for its solution. 4. It is easily dissolved by acids, and is precipitated from the concentrated solutions by potash, in which it is insoluble. 5. Strong nitric acid imparts to it a reddish colour, owing to the presence of brucia. 6. Sulphuric acid produces no apparent change: but when to the mixture a small crystal of bichromate of potash, of ferricyanide of potassium, or a small quantity of black oxide of manganese or of peroxide of lead is added, a series of beautiful purple and violet colours appear, which pass rapidly to a light red tint.

In *Organic mixtures*, the process of *Stas* is generally preferred for the separation of this poison. The principle of its operation consists in dissolving the strychnia by rectified spirit mixed with a vegetable acid (the tartaric, oxalic, or acetic). The acid solution of strychnia in concentrated in a water-bath at a low temperature. The concentrated liquid is neutralized by potash or ammonia, and a slight excess of alkali is added. The alkalized liquid is then shaken in a long stoppered tube with its volume of a mixture consisting of equal parts of chloroform and ether. This liquid dissolves the strychnia set free by the alkali. It may be separated from the watery liquid by a pipette, and the acid submitted to spontaneous evaporation, when, if strychnia is present, crystals of the alkaloid will be obtained. These may be examined by the tests above described. For further details respecting this process, I must refer the reader to my work On Poisons, 1859, p. 786.

WOUNDS.

CHAPTER 21.

VARIOUS SURGICAL DEFINITIONS OF A WOUND—INJURY TO THE SKIN—LEGAL DEFINITION—AN ABRASION OF THE CUTICLE NOT A WOUND—ARE INJURIES OF THE MUCOUS MEMBRANE AND DISLOCATIONS WOUNDS?—WOUNDS DANGEROUS TO LIFE—THE DANGER IMMINENT—RULES REGARDING DYING DECLARATIONS—WOUNDS PRODUCING GRIEVOUS BODILY HARM.

When a person is the subject of a wound or external injury, from the effects of which he ultimately recovers, a medical witness is often rigorously examined with respect to the precise nature of the injury, and how far it involved a risk of life. The answers to these questions may have an important influence on the defence of a prisoner, when the crime is charged under particular forms of indictment.

Definition of a wound.—It may, I think, be safely asserted, that we shall look in vain for any consistent definition of a wound, in works on medicine and surgery. A wound is, perhaps, most commonly defined to be, a "recent solution of continuity in the soft parts, suddenly occasioned by external causes." Yet they who adopt this view, do not regard as wounds, ruptures of the liver or spleen, burns by heated bodies, or simple dislocations and fractures; although these injuries are comprehended in such a definition. The following definitions of a wound were furnished to me by three eminent surgeons:—

"A solution of continuity from violence of any natural continuous parts."

"An external breach of continuity directly occasioned by violence."

"An injury to an organic texture by mechanical or other violence."

Owing to the unsettled meaning of the word *wound*, it has happened on more than one occasion that medical witnesses have differed in their evidence; and some difficulty has arisen in the prosecution of criminal charges. It has been asserted that, in order to constitute a wound, the *skin* should always be *broken* or injured; and this, as we shall see presently, is the interpretation commonly put upon the term by our judges. But those who adopt this definition do not regard *burns*, produced either by heated metals or corrosive liquids, as wounds; although there seems to be no good reason why they should be excluded. Technical difficulties of this kind, which only lead to the embarrassment of witnesses and to the acquittal of prisoners charged with serious offences, might be avoided if the medical witnesses of England were allowed to adopt the comprehensive definition sanctioned by the legal tribunals of certain States on the Continent, namely, that "a wound includes every description of personal injury, arising from whatever cause, applied externally." It may appear contrary to propriety to designate a contusion or fracture as a wound; but the common definitions will be found, on examination, to be equally inconsistent, and to be attended, in legal medicine, by evil results, inasmuch as they lead to acquittals, not upon the merits of the case, but upon the most trivial pretences. This could not happen if the above comprehensive definition was generally adopted. It appears to me, that in a case of this kind we should rather regard the wants of justice than the rules of surgery. If medico-legal cases fail from differences respecting the meaning of scientific terms among surgical writers, it is time that some fixed rule should be adopted. While the science of surgery cannot possibly suffer by such an innovation, the administration of the law will be rendered much more efficient. The statute, 14 and 15 Vic. c. 100, has, however, supplied a remedy for some of the evils which have hitherto arisen from a misdescription of personal injuries in indictments.

Legal definition.—It cannot be denied that an alteration in the use of medical terms must, in order to be attended with any good effects, receive the support of our legal authorities. This, probably, would not be long withheld, if good reasons for the change were afforded by medical witnesses. The present rule appears to be, that *no injury constitutes a wound in law, unless the continuity of the skin be broken*; so that in a case in which blows were inflicted with a hammer or iron instrument sufficient to break the collar-bone, and violently bruise but not break the skin, it was held not to be a wounding within the statute. (*R.* v *Wood*, Matthew's Digest, p. 415.) The Act 1 Vict. c. 85, has in some measure provided for the punishment of persons guilty of inflicting such severe injuries, but still it has left the legal signification of the word wound, unsettled. The 14 and 15 Vict. c. 100, is still more precise, but this also avoids the definition of a wound.

In order to remove any difficulty in future cases, and to put an end to conflicting decisions, the Commissioners for codifying the Criminal law have suggested that *internal* breaches of continuity should be included under the term wound. They have defined a wound to be "*that whereby the skin is divided either externally or internally.*" The late Mr. Justice Talfourd objected to this definition, because, in his opinion, the division of the skin internally without a division externally was impossible. The use of the word "skin" leads to ambiguity; and, in this instance, it shows that those who frame laws are not sufficiently careful in the selection of professional terms. The skin consists of the cuticle and cutis. It has been held on more than one occasion that an abrasion of the *cuticle*, or outer skin only, is not a wound. A man was tried at the Central Criminal Court in August, 1838, on a charge of cutting and wounding the prosecutor. The prisoner struck the prosecutor a severe blow on the temple with a heavy stone bottle, which was thereby broken in pieces. The prosecutor fell senseless, and it was a long time before he recovered from the effects of the violence. The medical witnesses in this case underwent a rigorous cross-examination by the prisoner's counsel, respecting the meaning of the word "wound." They said that there had been a separation of the *cuticle* or outer skin of the temple, although there was no absolute wound in the usual acceptation of the word. They further deposed that the prosecutor had lost the sight of his left eye, and the hearing of his left ear; and he was for a considerable time in a state of great danger, from which he had scarcely recovered. The prisoner's counsel contended that the injuries were not such as to constitute cutting and wounding in law. The judges said, in order that a wound, in contemplation of law, should have been inflicted, it was necessary that the *whole skin*, and not the mere *cuticle*, should have been separated and divided: and as the evidence did not show distinctly that there was such a wound, those counts of the indictment could not be sustained. The prisoner was found guilty of an assault. A division of the *cutis* or true skin has always been regarded as a wound, whether blood is effused or not. The boundary of the cutis towards the inside of the body is not easily determined; since there is a gradual transition of the cutis into the subjacent fibrous tissue, in which the fat and sudatory glands are contained. According to Quain and Sharpey (Elements of Anatomy, vol. 1. p. 285), the cutis measures in thickness from a quarter of a line to a line and a half (a line being about one-twelfth of an inch). It is thicker in some parts than in others. Taking the true skin, or cutis, at the thickness usually assigned, it is impossible to conceive that such a very thin layer of membrane as this can be divided internally without an external division being produced. Allowing the maximum thickness of the eighth of an inch, it would be difficult for any medical man to affirm that a fractional part of this membrane had been divided internally, when there was no evidence of external separation; and it would be certainly impossible for him to prove it. What the Commissioners probably mean, is a division of the structures beneath the skin. Their definition is, however. vague and unsatisfactory, because it does not reach an important class of cases in which wounds are inflicted not in the skin, but in the mucous membrane lining the outlets of the body. Thus cuts, punctures, or lacerations of the lining membrane of the nostrils, mouth and throat, rectum and vagina, are undoubtedly wounds, although the skin may not be directly touched by the weapon. Injuries of a serious description have thus been frequently inflicted on females by cutting and pointed instruments: they have been hitherto properly treated as wounds, but they would not be comprised under this term by a strict adherence to the proposed definition. The subjoined case shows that an injury to the *mucous membrane* is regarded as a wound in law. The prisoner was charged with maliciously wounding a mare. He had thrust forcibly down the throat of the animal a stone, which had torn the throat and gullet. It was objected that the injury was not a wounding within the statute, the parts injured being *internal*, and there being no proof of an external blow or violence. The judge who tried the case was of opinion that it fell within the statute. Blood had flowed from the broken skin, or membrane lining the throat, and the stone was forced into the flesh; and it had been held that the injury need not be "external" to bring the case within the statute. The prisoner was convicted. (*Reg.* v. *Bolton*, Norwich Summer Assizes, 1849.) Other cases, in which the vagina in females has been thus wounded are given under the section of Wounds of the Genital Organs.

Do all breaches of continuity involving the skin or mucous membrane fall under the head of wounds? Burns appear to constitute an exception; but there is no reason why a burn producing a destruction of the skin, as by a red-hot poker, should not be regarded and treated in law as a wound. No definition of a wound, medically or legally, can be contrived so as to exclude such an injury. The question, however, mainly to be considered is this—May not a breach of continuity be regarded as a wound, although neither the skin nor the mucous membrane is directly implicated in the injury? Is a simple dislocation or fracture a wound? Is a rupture of the bladder, liver, or other organ, suddenly caused by external violence without implicating the skin, to be regarded as a wound? In a case before the Queen's Bench in November, 1847, it was held that *a dislocation was a wound.* An action was brought against a medical practitioner for negligence in the treatment of a dislocation of the arm, and a verdict was returned for the plaintiff. An application was made to the Court for a new trial, on the ground of a misdirection of the Chief Baron, who tried the case. The declaration alleged that the plaintiff had employed the defendant, who was a surgeon, for the treatment and cure of certain *wounds, fractures, bruises, complaints, and disorders*: but the evidence showed that the defendant had been employed to cure the plaintiff of a *dislocated arm.* At the close of the plaintiff's case, it was submitted that there was no word in the declaration which was applicable to the case: but this objection was overruled. A dislocation, it was argued, was neither a wound, bruise, nor fracture; and the words "complaint and disorder" were not at all applicable to a surgical case, but to internal complaints which require to be treated medically. Lord Denman, in delivering the judgment of the Court, said, "It is rather strange that the pleader should have omitted the most appropriate word: but we think the Chief Baron was quite right.—Rule refused." With respect to *fractures*, it was held in *Rex* v. *Wood* (4 C. and P., p. 381), that a fracture of the collar-bone was not a wounding within the statute, because the *skin* was not broken. There are, however, at least two recent cases in which contrary decisions have been given. The first of these is *Reg.* v. *Smith* (8 C. and P., 173). In this case prisoner struck prosecutor with an iron hammer on the side of the face. A surgeon from the London Hospital deposed that the lower jaw was broken in two places; that the *skin* was broken *internally* but *not externally.* There was not a great deal of blood effused. On the objection being taken that this was not a wound within the statute, Denman, C. J., observed, "If it is the immediate effect of the injury, we think we cannot distinguish this from the cases already decided;" and Parke, J. (in summing up), said, "We were of opinion that there was a wound, and upon consideration, I am more strongly of that opinion than I was at the outset. There must be a wounding: but if there be a wound (whether there be an effusion of blood or not), it is within the statute whether the wound is internal or external." The same point arose in another case. (*Reg.* v. *Warman*, 1 Denison, C. C. 183.) This was an indictment for inflicting a mortal wound: and a question arose whether it was supported by proof of a blow which caused an internal breach of the skin (although externally there were only the appearances of a bruise). The death of the deceased had been caused by a single blow on the head by a piece of wood: and the medical witness described the injury as follows: "I found on examining the head no *external* breach of the skin. I found a collection of blood in the back part of the head: the deceased died from effusion of blood, which pressed on the brain. On examining the scalp, I found a collection of blood between the scalp and cranium, just above the spot where, within the cranium, I had found the pressure on the brain. I call that a contused wound with effusion of blood; that is the same thing as a bruise. The internal part of the skin was broken. Medically, we call the breaking of the skin, whether broken externally or internally, a wound." This case was reserved for the judges, and considered by Denman, Tindal, Pollock, Alderson, Williams, Creswell, Parke, Coltman, Wightman, Patteson, Erle, and Platt. All thought that this *internal wound* was a sufficient wound to support the allegation in the indictment.

In each of these cases the Court appears to have been misled by the medical witnesses affirming that the skin (cutis) *was broken internally but not externally.* There is no doubt that they intended by this, not the cutis merely, but the areolar fatty tissue and soft parts beneath. Their evidence has, however, served to mislead the Commissioners, and to induce them to propose a faulty and erroneous definition. I know no instance in which a rupture of the bladder or liver, without any external injury, has been called a wound, although this term might be applied with as much propriety to this kind of injury as to a simple fracture or dislocation. The brain is sometimes lacerated by a blow on the skull which does not break the skin. This must be regarded as a wound of the brain; it admits of no other description. Two of the definitions given ante, p. 212, include all injuries of this kind; but it appears to me that the best definition which we can at present give to the word "wound," is that it implies "a breach of continuity in any of the structures of the body suddenly occasioned by violence." I have good authority for stating that these refinements and technicalities are not met with in the law of Scotland. The amount of injury inflicted, and the intention of the assailant, are alone regarded.

Wounds dangerous to life.—A medical witness is often asked whether a wound is or is not dangerous to life. In reference to persons charged with an attempt to murder or maim, a written medical opinion, or a deposition, may be demanded of a surgeon by a magistrate, in order to justify the detention of prisoners. The law has not defined the meaning of the words, "*dangerous to life*," or stated to what kind of wound the term *dangerous* should be applied. This is a point which is left entirely to the professional knowledge of a witness. It is not sufficient on these occasions that a witness should make a naked declaration of the wound being dangerous to life; he must, if called upon, state to the Court satisfactory reasons for this opinion; and those reasons are rigorously inquired into by the counsel for the defence. As a general principle it would not be proper to consider those wounds dangerous to life, in which the danger is not *imminent.* A wound of a great blood-vessel, of any of the viscera, or a compound fracture with depression of the bones of the head, must in all instances be regarded as bodily injuries dangerous to life; because in such cases the danger is imminent. Unless timely assistance be rendered, these injuries will most probably prove fatal, and, indeed, they often destroy life in spite of the best surgical treatment. When, however, the danger is remote, as in a puncture or laceration of the hand or foot, which may be followed by tetanus, or in a laceration of the scalp, which may be followed by erysipelas, or in penetrating wounds of the orbit, which may be attended by fatal inflammation of the brain or its membranes, the case is somewhat different. Such injuries as these are not directly dangerous to life,—they are only liable to be attended with danger in certain cases; and therefore the medical opinion must be qualified. The law, on these occasions, appears to contemplate the direct and not the future or possible occurrence of danger; if the last view were adopted, it is clear that the most trivial lacerations and punctures might be pronounced dangerous to life; since tetanus or erysipelas proving fatal, has been an occasional consequence of very slight injuries. A difference of opinion will often exist among medical witnesses as to whether a particular wound is or is not dangerous to life. Unanimity can only be expected when the judgment and experience of the witnesses are equal. The rules for forming an opinion in these cases, will, perhaps, be best deduced from the results of the observations of good surgical authorities in relation to injuries of different parts of the body. This will form a subject for consideration hereafter.

Dying declarations.—The wound may be of such a nature as to cause death speedily, so that a practitioner may arrive only in time to see the wounded person die. In this case, the dying person may make a statement or declaration as to the circumstances under which the wound was inflicted: he may also mention the names of the parties by whom he was assaulted. This *dying declaration* or statement, according to the circumstances under which it is made, may become of material importance in the prosecution of a party charged with homicide. It is therefore proper that a practitioner should notice the *exact condition* of the dying person: whether at the time he makes the statement, he is under the conviction that he must die, either expressed in language or implied by his conduct. According to some authorities, it is not necessary that a man should declare that he believes himself to be dying, in order to render his statement admissible; but he must, at the time of making it, be under the full conviction of approaching death. The question respecting the admissibility of a dying declaration was argued in the Court of Exchequer, January, 1845, in *Reg.* v. *Howell*, when Alderson, B. said it was not necessary that the deceased should be *in articulo mortis*, or even that he should *think* so. It is enough if he thinks he shall die of the sickness under which he labours. (Law Times, Jan. 25, 1845, p.

317.) When it is made clear to the Court that all hope of life was lost, the statement will be received as evidence against an accused person; for the law supposes, that in the act of dying, all interest in this world is taken away; and that the near contemplation of death has the same powerful effect upon the mind, as the solemn obligation of an oath. It is presumed that there can be no disposition on the part of a dying person to wilfully misrepresent facts, or to state what is false. Much, therefore, often depends on the conduct of a medical practitioner under such circumstances; for the usual method of testing the truth of a statement by cross-examination is, of course, out of the question: it must, if admitted at all, be received as it was made.

It was formerly believed, that if the person at the time of making the statement had still some *hope of recovery*, it would not be legally admissible. This question was raised in *Mr. Seton's* case (*Reg.* v. *Pym*, Hants Lent Ass., 1846). The deceased had been told by his medical attendant, Dr. Stewart, that there was "not the least hope of recovery." He then made a statement, and two or three hours *after*, he asked the surgeon whether he thought he was better; but his (the witness's) conviction was that he then believed that his immediate death was approaching. Counsel for the prisoner objected that this declaration was not admissible. It plainly appeared, from the question put by the deceased, that he had not given up all hope of recovery, but that he still thought he might recover. (*Christie's* case, 2 Russ. on Crimes, 754; *Bonner's* case, *ib.* 759; and 6 Car. and P. 386; *Fagent's* case, 7 Car. and P. 238.) "ERLE, J.: I think the evidence is admissible. The principle is that a person who speaks with the conviction that his death is fast approaching, speaks under such a sense of responsibility, that the law presumes that he will tell the truth. Here Mr. Seton had a firm belief that his death was fast approaching. Upon the answer of the surgeon, he burst into tears, and thanked the medical men for their exertions. It has, no doubt, been held in some cases that *all hope* must be given up, but this is now decided not to be necessary. Indeed, if it were so, no declarations could be received, for scarcely a human being could be found, in any circumstances, who would not retain some hope. *The law admits these declarations, not because recovery is impossible, but because there is the conviction of approaching death.* Mr. Seton was shown to be in this state; the evidence is admissible. The statement was then received." (Law Times, March 21, 1846, p. 500.) It is not, therefore, necessary, that to render a declaration valid, the person making it must entertain "no hope of recovery." At the Special Commission in Ireland (Jan. 1848, *Reg.* v. *Butler*), a declaration was admitted where the words were, that the deceased entertained "little or no hope" of recovery. In *Reg.* v. *Bayley* (Exchequer Chamber, Jan.

1857), in which it appeared that the surgeon had given some hope to the dying person before the declaration was made, while the declarant stated that he did not himself believe that he could recover ultimately, its reception was objected to on the part of the prisoners because the surgeon had given the man some hope. He died two days afterwards. Pollock, C. B. ruled that the real belief of the man was the question, and here he had said, notwithstanding the opinion of the surgeon, he believed he could not recover. In the case of *Reg.* v. *Harvey* (Exeter Summer Assizes, 1854), the chief evidence against the prisoner consisted of certain statements made by the deceased. They were admitted by Wightman, J. because it appeared clearly from the evidence that when they were made, deceased had expressed an opinion that she should die shortly, and had not changed that opinion. Her whole conduct intimated that she had no hope. It was observed on this occasion that the medical and other witnesses were more desirous of telling the deceased her state, than of ascertaining what her own opinion was.

It is no part of the duty of a medical witness to form a judgment on this important subject. He should give the statement as it was made, and leave the Court to decide upon its admissibility from the circumstances carefully observed by him with respect to the condition of the patient. He should not render himself officious, in extracting information. He should receive what is *voluntarily uttered*, and, either immediately or on the earliest possible opportunity, write down the statement in the *identical* words, carefully avoiding his own interpretation or any paraphrase of them. On no account should leading questions be put:—and any question should be simply confined to the purpose of explaining what may appear ambiguous or contradictory in the declaration. It is well known that when death takes place from violence, especially when this proceeds from loss of blood or a wound of the head, delirium is apt to supervene, or the intellect of the dying person becomes confused. Under these circumstances, great caution should be used in receiving a declaration, since it may lead to the implication of innocent parties. It is also proper to remark, that the identity of a person is, under these circumstances, liable to be mistaken; and that it is in general an injudicious proceeding to take a suspected party before one who is dying, in order that he may be identified. A fatal mistake of this kind was made many years since in London. A woman was maltreated by some men on Kennington Common:—she was taken to St. Thomas's Hospital: and while dying from the effects of the violence, a suspected party was brought before her, as one of the supposed assailants: she stated that he was one of those who had assaulted her. The man was tried, upon her declaration, respecting his identity,—found guilty and executed: but a year after the execution, his innocence was satisfactorily established by the discovery of the real murderers!

In *Reg.* v. *Qualter* (Stafford Lent Assizes, 1854), the escape of a criminal was attributed to the neglect of the medical attendant in reference to a dying declaration. The deceased was grossly ill-treated, as it was alleged, by the prisoner and others. He lingered from the 19th June until the 8th of August, 1853, when he died from the injuries received. On his death-bed he made certain statements implicating the prisoner, and upon these the case for the prosecution chiefly rested. Qualter was tried for the murder. The deceased told his wife that he knew he should not recover, but as the declaration against Qualter was made previously, it was of course inadmissible. A similar declaration affecting the prisoner was subsequently made by the deceased to the medical attendant; and it seems that this witness had told the wife that her husband would not recover. but not in the presence of the deceased: hence the declaration made to him was inadmissible, and the prisoner was acquitted. There was a want of proof, in fact, that either declaration had been made by the dying man while he was under the conviction of approaching death. It is probable that had the surgeon announced to the deceased that he could not recover, or had he made the announcement to the wife in his presence and hearing, the declaration would have been admissible. It is certainly advisable, in all cases when a medical man perceives that the recovery of a wounded person is impossible, that he should take the first opportunity of stating his opinion to the individual, so that the ends of justice may not be defeated by reason of the non-observance of these legal forms. (See also the case of *Reg.* v. *Harvey*, Exeter Summer Assizes, 1854.)

Wounds causing grievous bodily harm.—If the witness admits that the wound is not dangerous to life, then he may be required to state whether it was such as to have produced "*grievous bodily harm.*" This question is sometimes put, although the usual practice is to leave it as an inference to be drawn by the jury from a professional description of the injury. These words have a vague signification; but it would perhaps be difficult to substitute for them others less open to objection. They evidently refer to a minor description of offence, and are applied commonly to those injuries which, while they are not actually dangerous to life, may be attended with considerable personal inconvenience, or be in some way detrimental to the health of the wounded party. It is always a question for a jury, whether the *intent* of the prisoner, in inflicting a wound, was or was not to produce grievous bodily harm. Sometimes the nature or the situation of the wound, as well as the kind of weapon used, will at once explain the intent: so far the medical witness may assist the Court, by giving a plain description of the injury, as well as of the consequences with which it is usually attended. It may happen that the wound itself is not of a serious nature, and yet the intention of a prisoner may have been to do grievous bodily harm to the wounded person; or, as in the following case, the injury may be really serious, and yet the prisoner may not have intended to do grievous bodily harm. A man was indicted for feloniously wounding a girl, with intent to do grievous bodily harm. He kicked her in the lower part of her abdomen,—the surgeon described the injury as of the most serious character, and said that at one time he considered the life of the prosecutrix in danger. She was still suffering, and would probably feel the effects of the injury for the rest of her life. The judge, in summing up the case, told the jury that the material question for them to consider was the *intent* of the prisoner. It was not because serious injury was the result of a prisoner's act, that they were therefore to infer his intention was to do that injury; and they were to judge from all the circumstances, whether, at the time he kicked the prosecutrix, he intended to do her grievous bodily harm, as was imputed to him by the indictment, or whether he was merely guilty of a common assault. He was found guilty of a common assault. (*Reg.* v. *Haynes*, Central Criminal Court, September 1847.) In cases of this description, the intent with which a wound was inflicted must be made out by evidence of a non-medical kind. (See also the case of *Reg.* v. *Maslin*, Devizes Summer Assizes, 1838.)

These are the principal medico-legal questions connected with wounds when the wounded person is seen while *living*. We will suppose, however, that the wounded person is found dead, and an examination of the body is required to be made. The most difficult part of the duty of a medical jurist now commences. Among the numerous questions which here present themselves, the first which demands examination is, whether the wound was inflicted on the body before or after death.

CHAPTER 22.

EXAMINATION OF WOUNDS IN THE DEAD BODY—ALL THE CAVITIES SHOULD BE INSPECTED—ACQUITTALS FROM THE NEGLECT OF THIS RULE—CHARACTERS OF A WOUND INFLICTED DURING LIFE—OF A WOUND MADE AFTER DEATH—EXPERIMENTS ON AMPUTATED LIMBS — CAUTION IN MEDICAL OPINIONS — WOUNDS OR INJURIES UNATTENDED WITH HÆMORRHAGE — ECCHYMOSIS FROM VIOLENCE — EVIDENCE FROM ECCHYMOSIS — ECCHYMOSIS FROM NATURAL CAUSES— IN THE DEAD BODY — LIVIDITY — VIBICES — EFFECT OF PUTREFACTION — IS ECCHYMOSIS A NECESSARY RESULT OF VIOLENCE?

Examination of wounds.—In examining a wound on a dead body, it is proper to observe its situation, extent, length, breadth, depth, and direction:—whether there is about it effused blood, either liquid or coagulated, and whether there is ecchymosis in the skin. It should also be ascertained whether the surrounding parts are swollen,—whether adhesive matter or pus is effused—whether the edges of the wound are gangrenous, or any foreign substances are present in it. Care must be taken that putrefaction is not mistaken for a gangrenous condition of the wound. The wound may be examined by gently introducing into it a bougie, and carrying on the dissection around this instrument, avoiding as much as possible any interference with the external appearances. The preservation of the external form will allow of a comparison being made at any future time between the edges of a wound and a weapon found on a suspected person. Of all these points *notes* should be taken, either on the spot or immediately afterwards. In the dissection, every muscle, vessel, nerve, or organ involved in the injury should be traced and described. This will enable a witness to answer many collateral questions that may unexpectedly arise during the inquiry. Another point should be especially attended to. A medical practitioner has frequently contented himself by confining his dissection to the injured part, thinking that on the trial of an accused party the questions of counsel would be limited to the situation and extent of the wound only: but this is a serious mistake. If the cause of death be at all obscure, on no account should the inspection be abandoned until all the important organs and cavities of the body have been closely examined; since it may be affirmed that a natural cause of death might have existed in that organ or cavity which the medical witness had neglected to examine. (*Reg.* v. *Solloway*, Abingdon Aut.

Ass. 1860.) It rests with the practitioner to disprove the probability thus urged by counsel, but he is now destitute of facts to reason from: legal ingenuity will triumph, the witness will be discomfited, and the prisoner, of whose guilt there may be, morally speaking, but little doubt, will have the benefit of his inattention, and be acquitted by the jury.

In making an inspection of the body, the state of the *stomach* should not be overlooked. Death may have been apparently caused by violence, and yet really be due to poison. Wildberg was called upon to examine the body of a girl, who died while her father was chastising her for stealing, apparently from the effects of the violence. On the arms, shoulders, and back, many marks of violent treatment were found; and under some of them blood was effused in large quantity. The injuries, although severe, did not, however, appear sufficient to account for sudden death. He therefore proceeded to examine the cavities, and on opening the stomach, he found it very much inflamed, and lined with a white powder, which was proved to be arsenic. It turned out that on the theft being detected, the girl had taken arsenic for fear of her father's anger: she vomited during the flogging, and died in slight convulsions. Upon this, Wildberg imputed death to the arsenic, and the man was discharged. Dr. Geoghegan communicated to me a case which occurred in Ireland in 1853, in which a gentleman having taken eleven grains of strychnia, threw himself out of a window, and sustained great bodily injury. The surgeon finding so much more spasm than could be accounted for by the violence sustained, discovered the real state of the case from the patient's confession. There was also evidence of the purchase of the poison. The cause of death may be easily assigned in such cases when the circumstances are known; but it is evident that without proper inquiry and great care in conducting examinations after death, the apparent may be sometimes mistaken for the real cause. (For some interesting cases and good practical suggestions on this subject, see Belloc, Cours de Méd. Lég. 148.) Even when there may be no suspicion of poisoning, it will be necessary to observe the state of the stomach and its contents—*i. e.* to determine whether it contains food, the nature of the food, and the degree to which it may have undergone digestion. In the case of *Reg.* v. *Spicer* (Berks Lent Assizes, 1846), the falsehood of one part of the prisoner's defence was made evident by an examination of the stomach. The deceased was found dead at the foot of a stair. The prisoner stated that *after* he and his wife had had their dinner, he heard a fall. The woman had died instantaneously, and the fall was heard by neighbours at or near the dinner-hour. Mr. Hooper, the medical witness, found the stomach quite empty: there was no trace of food. It was therefore clear that this part of the prisoner's story was untrue, as, had the deceased died immediately after dinner, some portion of undigested food would have been found.

Characters of a wound inflicted during life.—If we find about the wound marks of gangrene, the effusion of adhesive or purulent matter, or if the edges are swollen and enlarged, and cicatrization has commenced, it is not only certain that the injury must have been inflicted before death, but that the person must have lived some time after it was inflicted. Marks of this description will not, however, be commonly found when death has taken place within ten or twelve hours from the infliction of the injury. A wound which proves fatal within this period of time will present throughout much the same characters. Thus, supposing it to have been *incised*, there will be traces of more or less hæmorrhage, having chiefly an arterial character, and the blood will be coagulated where it has fallen on surrounding bodies: the edges of the wound are everted, and the muscular and cellular tissue around is deeply reddened by effused blood. Coagula are found adhering to the wound, provided it has been interfered with. The principal characters of a wound inflicted during life are, then, the following:—1. Eversion of the edges, owing to vital elasticity of the skin. 2. Abundant hæmorrhage, often of an arterial character, with general infiltration of blood in the surrounding parts. 3. The presence of coagula. The wound may not have involved any vessel, and there may be no appearance of bleeding,—still the edges will be everted, and the muscles and skin retracted. By an observation of this kind made on the body of a new-born child (Case of *Elphick*, March 1848), Mr. Prince was enabled to state that the child was living when it was inflicted — an opinion afterwards confirmed by the confession of the mother.

Characters of a wound made after death.—If the wound on a dead body be not made until twelve or fourteen hours have elapsed from the time of death, it cannot be easily mistaken for one produced during life. Either no blood is effused, or it is of a venous character— *i. e.*, it may have proceeded from some divided vein. The blood is commonly liquid, and does not coagulate as it falls on surrounding bodies, like that poured out of a wound in the living. The edges are soft, yielding, and destitute of elasticity; they are therefore in close approximation. The cellular and muscular tissues around are either not infiltrated with blood, or only to a very partial extent. There are no coagula within the wound. In experimenting upon amputated limbs, I have found these characters possessed by a wound produced two or three hours after death, although they are best seen when the wound is not made until after the body has lost all its animal heat. In wounds on the dead body, divided arteries have no marks of blood about them: in the living body the fatal hæmorrhage commonly proceeds from these vessels: hence in a wound on the living, it will be found that the surrounding vessels are empty. The chief characters of a wound after death are, therefore:—1. Absence of copious hæmorrhage. 2. If there is bleeding it is exclusively venous. 3. The edges of the wound are close, not everted. 4. There is no infiltration of blood in the cellular tissue. 5. There is an absence of coagula. But it may happen that a wound has been inflicted soon after the breath has left the body, and while it was yet warm. The distinction between a wound then made and one made during life is not so well marked as in wounds inflicted at a later period after death. Observations of this kind on the human subject must of course be purely accidental; and there are many obstacles to the performances of experiments on the recently dead. I, therefore, selected limbs immediately after amputation; and there is no reason to suppose that the results obtained in these cases would differ widely from those derived from experiments made on the entire body.

Wounds on the dead body.—In the first experiment, an incised wound, about three inches in length, was made in the upper part of the calf of the leg *two minutes* after its separation from the body, by which the thick muscles of the calf, and the fascia (membrane) covering the deep-seated layer of the leg, were divided. At the moment that the wound was made, the skin retracted considerably, causing a protrusion of the adipose substance beneath; the quantity of blood which escaped was small,—the cellular membrane, by its sudden protrusion forwards, seeming mechanically to prevent its exit. The wound was examined after the lapse of twenty-four hours: the edges were red, bloody, and everted; the skin was not in the least degree swollen, but merely somewhat flaccid. On separating the edges, a small quantity of fluid blood escaped, but no coagula were seen adhering to the muscles. At the bottom of the wound, however, and in close contact with the fascia, was a small quantity of coagulated blood: but the coagula were so loose as readily to break down under the finger. In a second experiment, *ten minutes* after the separation of the member from the body, an incision of similar extent was made on the outer side of the leg, penetrating through the peronei into the flexor longus pollicis of the deep-seated layer of muscles. In this case the skin appeared to have already lost its elasticity, for the edges of the wound became but very slightly everted, and scarcely any blood escaped from it. On examining the leg twenty-four hours afterwards, the edges of the incision were pale, and perfectly collapsed, presenting none of the characters of a wound inflicted during life. Still at the bottom of the wound, and inclosed by the divided muscular fibres, there were some coagula of blood; but these were certainly fewer than in the former experiment. A portion of liquid blood had evidently escaped owing to the leg having been moved. Other experiments were performed at a still later period after the removal of the limbs; and it was found that in proportion to the length of time suffered to elapse before the production of a wound, so were the appearances less distinctly marked: that is to say, the less likely were they to be confounded with similar injuries inflicted upon a *living* body. When the incised wound was not made until *two or three hours* after the removal of the limb, although a small quantity of liquid blood was effused, no coagula were found.

It is necessary to remember that, when an incised wound is the cause of death, the person dies either immediately, in which case there is copious bleeding from the wounded organ or some large vessel, — or he dies after some time, in which case, as the wound continues to bleed during the time that he survives, the longer he lives the more copious will be the effusion of blood. In a wound inflicted after death and while the body is warm, nothing of this kind is observed. Unless the weapon injure one of the large veins, the bleeding is always slight, so that the *quantity of blood* lost may assist us in determining whether the wound was made during life or after death. When the body has been moved, and all marks of blood effaced by washing, rules of this kind cannot serve a medical witness: — the time at which the wound was actually inflicted must then be deduced from other circumstances. In the case of *Greenacre*, who was tried in 1837 for the murder and mutilation of a female, this formed a material part of the medical evidence. The head of the deceased had been severed from the body, and the question was, whether this severance had taken place during life or after death. The prisoner alleged in his defence that it was after death; but the medical evidence went to establish that the head must have been cut off while the woman was living, but probably after she had been rendered insensible by a blow on that part, the marks of which were plainly visible. This medical opinion was founded on two circumstances. The muscles of the neck were retracted, and the head was completely drained of blood, showing that a most copious and abundant flow must have ensued at the time of separation; and therefore indicating that the circulation was probably going on at that time. On cutting off a head after death a small quantity of blood may escape from the jugular veins: but this soon ceases, and the quantity lost is insufficient to affect materially the contents of the cerebral vessels. The chief medical witness, Mr. Girdwood, expressed himself with proper caution, by stating, in answer to a question from the judge, that all the wounds in the neck had been inflicted either *during life or very shortly after death*, while the body still preserved its warmth. The circumstantial evidence tended to show that the deceased was first stunned, and that her head was cut off while she was in a state of stupor.

In any case in which it is doubtful whether a wound was inflicted on a living or dead body, it will be proper to adopt the same cautious mode of expressing a medical opinion: since it must be remembered there are no decisive characters by which wounds of the kind referred to can be distinguished; and a medical witness is as likely to be wrong as right in selecting either hypothesis. It is a considerable step in evidence, when we are able to assert, that a particular wound, found on a dead body, must have been inflicted either during life or *immediately* after death; for it can scarcely be supposed that in a case calling for criminal investigation, any one but a murderer would think of inflicting upon a body immediately after death a wound which would assuredly have produced fatal effects had the same person received it while living. So soon as such an opinion can be safely expressed by a witness, circumstantial evidence will often make up for that which may be, medically speaking, a matter of uncertainty.

Wounds or injuries unattended with hæmorrhage.—The copious effusion of blood has been set down as a well-marked character of a severe wound received during life; but this observation applies chiefly to cuts and stabs. Lacerated and contused wounds of a severe kind are not always accompanied by much bleeding, even when a large blood-vessel is implicated. It is well known, that a whole member has been torn from the body, and that little blood has been lost; but in such cases coagula are commonly found adhering to the separated parts,—a character which indicates that the wound was inflicted either during life or soon after death. When a lacerated or contused wound involves a highly vascular part, although no large blood-vessel may be implicated, it is liable to cause death by loss of blood. In a case tried at the Liverpool Winter Assizes, 1847 (*Reg.* v. *Cawley*), the prisoner was charged with having caused the death of his wife by kicking her in the lower part of the abdomen. Copious bleeding followed, and in spite of medical assistance the woman died very shortly afterwards, evidently from exhaustion produced by the loss of blood. It was stated in evidence that there was no external laceration, but an examination of the body showed that a contused wound (of the genitals) had been produced internally, and had given rise to fatal bleeding. There is nothing at all remarkable in such a result, considering the great vascularity of these parts in the female.

Ecchymosis from violence.—Contusions and contused wounds are commonly accompanied by a discolouration of the surrounding skin, to which the term ecchymosis is applied. The subject of ecchymosis is of considerable importance in legal medicine, since it has often given rise to numerous difficulties and complicated questions. It consists essentially in the extravasation or effusion of blood from ruptured vessels into the surrounding cellular texture. An ecchymosis is in general superficial, affecting only the layers of the skin, and showing itself externally, either immediately or in the course of a short time, in the form of a deep blue or livid red patch. According to Dr. Chowne, the former colour is met with in the ecchymosis slowly produced; while that which is the immediate result of violence is red or livid red. In some instances the ecchymosis is deep-seated, — the blood being poured out among the muscles and beneath the fascia: its extent cannot then be so readily determined by the external discolouration, for this is commonly slight, and it appears only after the lapse of some hours, or even two or three days. Sometimes the ecchymosis shows itself not over the immediate seat of injury or around it, but at some distance from it. Dr. Chowne met with an instance in which a young man received a severe bruise on the inner side of the ankle. In two days, ecchymosis appeared around the outer ankle. When blood has once escaped from the small vessels, it will diffuse itself where it meets with the least resistance, and the layers of skin in the part struck, may become so condensed by the blow, that the blood is diffused in the cellular membrane of the adjoining parts. Mr. Syme met with a case in which a compound fracture of the tibia, about one-third down, was produced by the wheel of a carriage passing over the leg of a woman. There was no ecchymosis around the seat of injury; but after some days, the skin of the knee and lower part of the thigh became discoloured. (Ed. Med. and Surg. Jour. Oct. 1836.) Ecchymosis may sometimes proceed from causes irrespective of the direct application of violence to the skin. Strong muscular exertions—the act of vomiting, and many other conditions, may give rise to a rupture of the minute vessels, and to an effusion of blood in parts which have been stretched or compressed. I have known it to have been produced to a great extent around the knee (without any blow,) from the stretching of the ligament of the kneepan in an individual who was trying to save himself from suddenly falling forwards with his knee bent under him. Such cases are commonly recognized by there being no mark of mechanical injury about the part, — the skin is smooth and unabraded.

Ecchymosis strictly signifies the effusion or pouring out of blood; but the effusion may be so deep-seated as not to present any external discolouration (ecchymosis). It is scarcely necessary to observe that the term *effusion* applies to internal as well as to external hæmorrhage, and unless this be borne in mind medical testimony may be wholly misunderstood. Dr. Christison states that some years ago, on a trial in the High

Court of Justiciary at Edinburgh, the public prosecutor attempted to prove that the person assailed had been wounded to the *effusion* of blood, which, according to the law of Scotland, is an aggravation of guilt in such cases. When the principal medical witness was examined as to the injuries inflicted, he was asked whether any blood had been effused; and he replied that a good deal must have been effused. But he meant effusion of blood under the skin, constituting the contusion or bruise described, while the Court at first received the answer as implying that there had been a considerable loss of blood from a wound externally. The ambiguity was, however, detected. (Edinburgh Monthly Journal, Nov. 1851, p. 454.) This case shows the importance of medical evidence being given in language intelligible to all. At the same time the amount of personal injury inflicted is not at all dependent on the external effusion of blood. The assault may be of a most grievous kind, and yet no blood be effused through a wound in the skin.

Violence inflicted on a living body may not show itself under the form of ecchymosis until *after death*. A case of this kind was communicated to me by Mr. J. Steavenson. A man received from behind several kicks on the lower part of the abdomen, which caused a rupture of the bladder, and death by peritonitis. He died in about thirty-five hours; but there was no ecchymosis in the seat of the blows, *i. e.* the pubic and lumbar regions, until after death. Dr. Hinze met with a case of suicidal hanging, in which it was observed that ecchymosis appeared in the course of the cord only after death. (See HANGING.) It has been remarked by Devergie that ecchymoses are often concealed on the bodies of the drowned, when first removed from water, owing to the sodden state of the skin; they may become apparent only after the body has been exposed for some days, and the water has evaporated.

A medical jurist must guard against the error of supposing that when a blow has been inflicted on a living person, it is necessary that the individual who is maltreated should survive for a long period in order that ecchymosis should be produced. Among numerous instances proving the contrary, the case of the *Duchess of Praslin* (August 1847) may be mentioned. This lady, who was assassinated by her husband, was attacked while asleep in bed. The number of wounds on her person (thirty) showed that there had been a mortal struggle, which, however, could not have lasted more than *half an hour*. Yet, on inspection, there were the marks of numerous ecchymoses, which had resulted from the violent use of a bruising instrument. (Ann. d'Hyg. 1847, t. 2. p. 377.)

Changes of colour.—The changes which take place in the colour of an ecchymosed spot are worthy of attention, since they will serve to aid the witness in giving an opinion on the probable time at which a contusion has been inflicted. After a certain period, commonly in eighteen or twenty-four hours, the blue or livid margin of the spot is observed to become lighter; it acquires a violet tint, and before its final disappearance it passes successively through shades of a green, yellow, and lemon colour. During this time, the spot is much increased in extent, but the central portion of the ecchymosis is always darker than the circumference. These changes have been referred to by Chaussier and others to the gradual dilution of the serous portion of the effused blood by the fluid of the cellular membrane, and its slow and uniform dispersion throughout the cells. The colour is finally entirely removed by the absorption of the blood. The extent and situation of the ecchymosis, the degree of violence by which it has been produced, as well as the age and state of health of the person, are so many circumstances which may influence the progress of these changes. Thus an ecchymosis is longer in disappearing in the old than in the young. Mr. Watson, of Edinburgh, found effused blood in an ecchymosis in an old person, five weeks after the infliction of the injury. Where the cellular membrane is dense, the ecchymosis, cæteris paribus, is not so rapidly formed; nor, when formed, do the above changes take place in it so speedily as when the blood is effused into a loose portion of membrane like that surrounding the eye or existing in the scrotum. In some instances an ecchymosis has been observed to disappear without undergoing changes of colour at its margin. On examining an ecchymosed portion of skin which has suffered from a severe contusion, we find that the discolouration affects more or less the whole substance of the true skin, as well as the cellular membrane beneath; it is necessary to remember this in forming our opinion.

Evidence from the form of an ecchymosis.—It not unfrequently happens that the ecchymosis produced by a contusion will assume a form indicative of the means by which the violence was offered. In hanging, the impression caused by the cord on the neck is sometimes ecchymosed, and indicates its course with precision; —so also in strangulation, when the fingers have been violently applied to the fore part of the neck, the indentations produced may serve to point out the manner in which life was destroyed. A case is mentioned by Starkie, which shows that the form of an ecchymosis may occasionally furnish presumptive evidence against an accused party. In an attempt at murder, the prosecutor, in his own defence, struck the assailant violently in the face with the key of the house-door,—this being the only weapon he had near at hand. The ecchymosis which followed this contusion corresponded in the impression produced on the face to the wards of the key; and it was chiefly through this very singular and unexpected source of evidence, that the assailant was afterwards identified and brought to trial. (Law of Evidence, vol. 1. art. Circ. Ev.)

Contusions on the dead.—For our knowledge of the effects of *contusions* on the recently *dead* body, we are chiefly indebted to Dr. Christison. This gentleman found that blows inflicted *two hours* after death, gave rise to appearances on the skin similar to those which resulted from blows inflicted recently before death. The livid discolouration thus produced generally arose from an effusion of the thinnest possible layer of the fluid part of the blood on the outer surface of the true skin, but sometimes also from an effusion of blood into a perceptible stratum of the true skin itself. He likewise found that dark fluid blood might even be effused into the subcutaneous cellular tissue in the seat of the discolourations, so as to blacken or redden the membranous partitions of the adipose cells; but this last effusion was never extensive. From this, then, it follows, that by trusting to external appearance only, contusions made soon after death may be easily confounded with those which have been produced by violence shortly before death.

If a contusion has been caused some time before death, there will be swelling of the part, and probably also certain changes of colour in the ecchymosed patch, in either of which cases there will be no difficulty in forming an opinion. Although ecchymosis, or an appearance analogous to it, may be produced after death, the changes in colour are then met with only under peculiar circumstances, to be presently mentioned. If the blood found beneath an ecchymosed spot be in the state of coagulum, this will afford a remote presumption of its having been effused during life, although, in fact, it only proves that the effusion must have taken place before death, or very soon after it. The experiments related, in speaking of incised wounds, show that the blood effused from a wound ten minutes after death may still be found in a coagulated state. (See page 226.) Again, the circumstance of the blood effused under a contused wound being *liquid*, is not a proof that the effusion took place after death; for sometimes, as in death from a sudden and violent shock to the nervous system, or in cases of rupture of the heart, the effused blood does not coagulate. Blood effused into the spinal canal during life is often fluid: and it is well known that the blood may be found coagulated in some parts of the body, while it remains uncoagulated in others. There is reason to believe that the blood coagulates more slowly in the dead body than in a vessel into which it has been drawn during life or after death. The blood may remain fluid in the dead body from four to eight, and, according to Donné, twelve hours after death (Cours de Microscopie, 52). It rarely begins to coagulate until after a lapse of four hours; but if drawn from a blood-vessel and exposed to air, it would coagulate in a few minutes after its removal.

In general those contusions which have been produced during life, and in which the effused blood remains liquid, may be recognised by the *extent* of the effusion. If, under the ecchymosed part, we find a large quantity of liquid blood, and the seat of injury is so situated that the blood could not have become infiltrated into it, and at the same time there is no ruptured vein from which it might have flowed, we may confidently pronounce that the effusion must have preceded death. In a dead body, a contusion would cause but little extravasation, unless a vein of large size were torn through. The sign which is most satisfactory as a criterion, in the opinion of Dr. Christison, is, however, the following:—In a contusion inflicted during life, the ecchymosed portion of cutis (true skin) is generally dark and much discoloured by the infiltration of blood throughout its whole thickness; the skin at the same time is increased in firmness and tenacity. This is not, however, a uniform consequence of a contusion during life; for a blow may cause effusion of blood beneath the skin without affecting the cutis in the manner stated. The state of the skin here described, cannot, however, be produced by a contusion on a dead subject; although it is questionable whether it might not be produced if the contusion were inflicted a few minutes after death. As it is, the value of this sign is somewhat circumscribed,—it is not always produced on the living,—it might be possibly produced on the recently dead; so that when it does not exist, we must look for other differential marks; and when it does exist, we ought to satisfy ourselves that the contusion was not inflicted recently after death.

The period at which such injuries cease to resemble each other, has not been fixed with any degree of precision; but, as in the case of incised wounds, it would seem that there is little danger of confounding them, when a contusion has not been inflicted on a *dead* body until after the disappearance of animal heat and the commencement of cadaveric rigidity. Dr. Christison found that sometimes the appearance of contusions could hardly be produced on the dead body two hours after death; at others they may be slightly caused after three hours and a quarter; but this period is very near the extreme limit. Whenever the warmth of the body and the laxity of the muscles are not considerable at the time the blow is inflicted, the appearance of contusions during life cannot be distinctly produced. It is, therefore, only on the trunk that, even in the most favourable state of the body,—namely, when the blood remains altogether liquid,—that a mark resembling a contusion on the living body can be produced so late as *two hours* after death. (Ed. Med.

and Surg. Jour. No. 99, p. 247. et seq.) Notwithstanding these satisfactory results, it will be seen, that from the moment of death until after a lapse of two hours, contusions may be followed by appearances on the dead almost identical with those observed on the living. The *earliest period* after death in which an experiment was tried on the human body was *one hour and three quarters:* in this case the similarity was so strong, that we may infer, if the experiments had been performed within half an hour, or even an hour after dissolution, it would have been difficult to say whether the blow producing the discolouration had been inflicted before or after death. Dr. Christison's experiments lead to the conclusion that *severe* blows inflicted on a recently dead body, produce no greater degree of ecchymosis or cutaneous discolouration than *slight* blows inflicted before death. Assuming that the great extent of an ecchymosis would in all cases serve to show that the violence producing it had been inflicted during life, it must be remembered that the importance of these facts, in relation to medical evidence, is not affected by the extent of the discolouration. It may be just as necessary to have a positive opinion on the origin of a *slight*, as on the origin of an *extensive* bruise. Trivial ecchymoses, as in cases of strangulation, if they can be certainly pronounced vital, may make all the difference between the acquittal or conviction of a person charged with murder. Again, slight ecchymosis on the bodies of the drowned may excite a suspicion of strangulation and subsequent immersion of the body in water. This question is quite irrespective of the *extent* of the ecchymosis,—the great point for a medical witness to consider is, whether it occurred during life or after death. Cases in which a mistake might easily have arisen, will be related in speaking of marks of violence on the drowned.

The practical inference, then, is, that these discolourations caused after death are liable to be mistaken for marks of violence to the living body. An instance has been communicated to me, on respectable authority, in which, for the sake of experiment, blows with a stick were inflicted on the recently dead body of a female, while still warm. The body was afterwards accidentally seen by non-professional persons, who were not aware of the performance of these experiments, and so strong was the impression, from the appearances, that the deceased had been maltreated during life, that a judicial inquiry was actually instituted, when the circumstances were satisfactorily explained. The fact, therefore, that severe blows after death resemble slight blows during life, is, in a practical view, unimportant. It does not aid our diagnosis, nor prevent serious mistakes from occurring.

Ecchymosis from natural causes in the living.—There are certain conditions of the body in which ecchymosed marks are found on the skin, that a witness must be careful not to confound with ecchymosis arising from violence. First with regard to the living body,—in aged persons, it is not unusual to find the legs and feet covered with livid patches, sometimes of considerable uniformity of colour, and at others much mottled. These discolourations, which, after death, might be mistaken for ecchymosis from violence, arise from the languor of the capillary circulation in such persons: the blood with difficulty finds its way through the venous capillaries, and the marks are commonly observed on the lower parts of the body, because they are far removed from the centre of circulation, and the blood has to rise contrary to gravitation. This is the condition which has been denominated by Andral, asthenic hyperæmia. (Andral, Anat. Pathol. t. 1. p. 40.) Similar discolourations are sometimes met with on the bodies of those who have died from scurvy, typhus, and other adynamic diseases. In persons severely affected with scurvy, it is well known that the slightest pressure on any part of the skin will suffice to produce a spot resembling the ecchymosis of violence, and arising like it from a rupture of minute cutaneous vessels; but the effusion of blood, which causes the discolouration, is commonly confined to the superficial layers of the true skin. These patches, under certain states of the system, occur spontaneously, and often cover the body to a great extent: when small, they take the name of *petechiæ*; but when extensive, in which case they bear some resemblance to the ecchymosis of violence, they constitute the pathognomonic character of the disease termed *purpura*. To all these effusions of blood in the living body, the term *Sugillation* (from *sugillatio*, a black mark) has been applied. Some medical jurists have attempted to draw a distinction between ecchymosis and sugillation: thus it is said: ecchymosis proceeds from external, sugillation from internal, causes,—ecchymosis is confined to the marks which occur in the living body, sugillation to those which occur in the dead:—in ecchymosis the vessels are ruptured, in sugillation there is mere congestion; again, some have considered that ecchymosis and sugillation might take place both in the living and in the dead. From this statement, it appears impossible to give a consistent definition of the meaning of either of these terms; but it is altogether unnecessary to make the attempt, for the error, after all, consists in the introduction of a superfluity of words to express a simple condition of the body, depending on different causes. Why, according to the view taken by Chaussier, an ecchymosis should not also be called a sugillation, it is difficult to say: for the definitions above given create no real distinction. I would advise a medical jurist to avoid the use of the term sugillation, if by employing it he considers that he is speaking of a condition essentially different from ecchymosis. It may be occasionally necessary to distinguish ecchymoses in the living body arising from infirmity or disease, from those which have their origin from violence. In regard to the spots or patches on the legs of old persons, the appearance of the body, and their general extent, enveloping, as they often do, the whole circumference of leg, are sufficient to establish a clear distinction. In distinguishing the spots of *purpura*, a difficulty may sometimes exist; but here also the appearance of the subject, the general diffusion of the spots over the whole of the body, and their simultaneous existence on the mucous membrane of the throat and alimentary canal, cannot fail to point out that they originate from some other cause than violence. In the living, these spots have been observed to undergo the same changes of colour as the true ecchymosis of violence. It has been alleged, on the authority of Zacchias, one of the early writers on medical jurisprudence, that a distinction is obtained in these cases after death by a dissection of the part. According to this authority, in what is termed sugillation, *i. e.* the ecchymosis of disease, the blood is fluid, while in the ecchymosis of violence it is described as being in a thick and concrete state. In the remarks already made respecting contusions, facts have been mentioned which show that such a mode of distinction is inadmissible; neither the state of the blood nor its situation will alone suffice to determine the question. Although it has been usual to describe the ecchymosis of disease as being due to a superficial extravasation on the true skin, yet certain cases recorded by pathologists prove that in purpura or scurvy the discolouration may occasionally extend through the whole substance of the skin to the fatty tissue beneath.

Ecchymosis in the dead body. Lividity. — Ecchymosis may present itself in various forms on the skin of a dead subject. The first form when it occurs, is almost an immediate consequence of death, but it is not fully developed until the body has cooled. It is commonly called *Cadaveric lividity.* It presents itself in diffused patches of very great extent, sometimes covering the whole of the fore part of the chest and abdomen, at other times the lateral regions of the back. The upper or lower extremities, either on their internal or external surfaces, or on their whole circumference, are often thus completely ecchymosed. The colour is sometimes purple, at others livid, and often mottled in interspaces; but it is commonly well-defined in its extent by the whiteness of the surrounding skin. This form of ecchymosis is generally seen on the bodies of those who die suddenly or by a violent death, as well as in persons who perish from apoplexy, or who are hanged or suffocated. When the skin is divided, the colour is found to be confined to the upper surface of the cutis, and never to extend through it. This discolouration is ascribed to the congestion which takes place in the capillary system at the moment of death, in subjects that are full of blood. It is rarely seen in the bodies of those who have died from profuse bleeding—the skin is in these cases commonly pallid. The circumstances under which it occurs, and the characters above described, distinguish it from the ecchymosis of violence. Its existence on a dead body must be regarded as a sign of the vigour and activity of the circulation at the moment of death, and generally as a mark of death having taken place suddenly. It might seem improper to call this which has been described as a mere capillary congestion, "*ecchymosis*," this word signifying effusion; but the term *sugillation* has been so vaguely employed by different writers, that I think the former preferable to the latter, in spite of the apparent inconsistency of its application to every variety of cutaneous discolouration. (See Henke, Zeitschrift der S. A., 1844, vol. 1. p. 199.)

Vibices.—(Weals.) Sometimes, instead of seeing this cadaveric lividity diffused in large patches over the skin, it will be disposed in stripes or weals which traverse and intersect each other in all directions, and often cover the whole surface of the body. These marks, which vary from a scarlet to a dark red or livid hue, have been supposed to resemble those produced on the skin by the act of scourging or flagellation. On this account they have received the above designation. Sometimes the body is completely covered with them,—they are often of considerable length, and pass in a symmetrical but occasionally tortuous course; they are chiefly observed about the sides, the upper part of the shoulders, and back. In meeting with this appearance for the first time on a dead body, an individual, unacquainted with its nature, might look upon it as a strong proof of violent treatment during life, especially in a case of suspected violence; but the practitioner will distinguish it readily, by the uninjured state of the cuticle and the superficial nature of the discolouration, from those marks of violence which it is considered to resemble. In general, it appears to be produced by the wrapping of a body in a sheet or other covering soon after death, and allowing it to cool while thus wrapped up; even if a dead body is allowed to cool merely with the clothes covering it, these peculiar marks will often be produced. In many cases they exist only on the back, and here they are to be ascribed to the pressure produced by the irregularities or folds in the sheet on which the body has been lying. The capillaries, it is to be observed, are always congested in or near those parts of the skin which are exposed to the least pressure. A few years since I saw a well-marked case of vibices, in which the suspicion was so strong that violence had been used to the deceased, that a coroner's inquest took place. The fore part of the body was covered with stripes, which were of a red and livid colour: they appeared to correspond exactly to the folds of a sheet drawn tightly across the chest; and it was subsequently ascertained that the body of the deceased had been treated in this manner after death. The blood was superficially diffused, and the cuticle uninjured. The circumstance above mentioned at once satisfactorily explained the cause of the appearance. These vibices or weals, like the cadaveric lividity already described, are commonly seen in plethoric persons; they indicate great vigour of circulation at the moment of death.

But lividity sometimes presents itself in a more deceptive form than in either of the instances just mentioned; as in the following case. A man, æt. thirty-three, died suddenly from disease of the heart. Eighteen hours after death, the body was examined, and the skin was then found to be covered in different parts with patches of ecchymosis, varying in size from small spots to others of several inches in diameter. These patches were evidently due to simple lividity, although they closely simulated marks of violence produced during life. On cutting into them the layers of the cutis as well as the cellular tissue beneath were throughout reddened by a congestion of blood. There was no decided extravasation, but small rounded semi-coagulated masses oozed out from the cells on slight pressure. There was another extraordinary circumstance, in which these patches of lividity resembled the ecchymosis of violence produced during life. Around many of them there was a wide border or ring of straw colour, with various shades of green, precisely similar to those witnessed in the disappearance of an ecchymosis from the living subject. By all medical jurists, it has been hitherto considered that these rings of colour when not depending on putrefaction, are peculiar to an ecchymosis of the living body, and are never seen in an ecchymosis taking place spontaneously after death. The occurrence of this case shows with what caution general rules should be framed for medico-legal practice. Had the body of this person been found lying dead exposed on a high road, and had it been proved that another man had been seen quarrelling with him, it is easy to imagine that an unfavourable medical opinion might have been expressed against the person accused of the violence. This kind of ecchymosis could only have been distinguished from that of violence during life, by the unruffled state of the skin, and the slight extravasation of blood compared with the extent of the ecchymosed surface. It is worthy of note, also, that the principal seat of the ecchymosis was in those parts which were recumbent or depending. The formation of the coloured zones around some of the patches of lividity was fully explained by the fact of the man having laboured under general dropsy. The serum effused in the cells here acted upon and diluted the blood as it became extravasated; and diffused it around, much in the same manner as the serous exhalation of the cellular membrane acts on the blood effused in the living body. A wax model of this remarkable appearance is preserved in the museum of Guy's Hospital, and is well worthy of inspection.

Effects of Putrefaction.—Another form of ecchymosis observed in the dead body, is that which occurs some time after death. This appears to proceed from an infiltration of blood into the depending parts of the body, and to be a result of incipient putrefaction. They who are much engaged in inspections are well aware that the skin of the back, especially that covering the loin and buttocks, often presents irregular discolourations resembling ecchymosis. The skin of the back of the head is a well-known seat of this form of ecchymosis. On cutting into the skin of any of these parts, the whole of the cutis is found to be more or less discoloured, and the fatty tissue is filled with a bloody serum, which readily escapes. In proportion as putrefaction advances, the discolouration becomes greater, passing from a dark red to a green colour. The general characters of this kind of ecchymosis are so well-marked, that it cannot easily be confounded with the ecchymosis of violence. The parts of the body in which it is known to occur as well as the state of the body, are circumstances which distinguish it from all the other forms described. This variety of ecchymosis is also termed sugillation by some medical jurists. (On the subject of Ecchymosis, see Ann. d'Hyg. 1838, t. 2. p. 383.)

Is ecchymosis a necessary result of violence?—This medico-legal question has often created great difficulty to medical witnesses. It has been repeatedly asserted in Courts of law, that no severe blow could have been inflicted on a deceased person in consequence of the absence of ecchymosis from the part struck; but we shall see that this assertion is entirely opposed to well ascertained facts. However true the statement may be that severe contusions are commonly followed by ecchymosis, it is open to numerous exceptions; and unless these are known to a practitioner, his evidence may mislead the Court. The presence of ecchymosis is commonly presumptive evidence of the infliction of violence: but its absence does not negative this presumption.

It was long since remarked by Portal, that the spleen had been found ruptured from blows or falls, without any ecchymosis or abrasion of the skin appearing in the region struck. This has been also observed in respect to ruptures of the stomach, intestines, and urinary bladder, from violence directly applied to the abdomen. Portal supposed that the mechanical impulse was simply transferred through the supple parietes of the abdomen to the viscera behind, as in the striking of a bladder filled with water. Whether this be the true explanation or not, it is quite certain that the small vessels of the skin often escape rupture from a sharp blow, so that their contents are not effused. A case is reported by Henke, in which a labouring man died some hours after fighting with another; and on inspection of the body the peritoneum was found extensively inflamed owing to an escape of the contents of the small intestines, which had been ruptured to a considerable extent. There was, however, no ecchymosis or mark on the skin externally, and the medical inspectors were inclined to affirm, contrary in this case to direct evidence, that no blow could have been struck; but others were appealed to, who at once admitted that the laceration of the intestines might have been caused by a blow, even although there was no appearance of violence externally. Mr. Watson states, that a girl aged nine, received a smart blow upon the abdomen from a stone. She immediately complained of great pain; collapse ensued, and she died in twenty-one hours. On inspection there was no mark of injury externally; but the ileum (small intestines) was found ruptured, its contents extravasated, and the peritoneum extensively inflamed. (On Homicide, p. 187.) Dr. Williamson, of Leith, met with a case in which a man received a kick on the abdomen from a horse:—he died in thirty hours from peritonitis. The ileum was found to have been torn completely across in its lower third. There was not the slightest trace of ecchymosis externally; and this fact is the more remarkable, since the blow was here struck by a somewhat angular or pointed body—the hoof of a horse. (Med. Gaz. May 1840.) In a fatal railway accident which occurred at Leicester in November 1854, there were no marks of external violence on the head, but Mr. Macaulay found a laceration of the left hemisphere of the brain with effusion of a large quantity of blood which had coagulated.

Many cases might be adduced in support of the statement that ecchymosis is not a necessary or constant result of a severe contusion; but those already related sufficiently establish the fact. This medico-legal question frequently arises in cases in which the bladder is ruptured, as, owing to the general absence of marks of violence, it is often alleged in defence that no blow or kick could have been inflicted on this part of the abdomen. The incorrectness of this view will be apparent by a reference to cases of ruptured bladder related in another part of this work. I am indebted to Dr. Easton of Glasgow, for a case of rupture of the liver, under circumstances in which the appearance of ecchymosis would have been generally expected as a result of violence. In January 1852, a woman, aged seventy-five, was run down by a cab in the streets of Glasgow, and died in less than half an hour. No ecchymosis existed, although four ribs on the right side of the chest at the lower part were broken, and the liver was ruptured in two places longitudinally, and throughout the entire length of its anterior and convex surface. The laceration of this organ had not been caused by the fractured ends of the ribs penetrating downwards, for of these there was no displacement, but the organ seemed to have burst in consequence of the heavy compression to which it had been subjected, which had not been sufficient, however, to occasion discolouration of the skin externally. That murderous violence may be produced by blows on a body without leaving any external marks, is proved by a case tried in Scotland (*Cuming* for the murder of his wife, Dec. 19, 1853). The woman died from a severe injury to the head; but she chiefly complained of great pain in one of her breasts, and in her chest on that side. From her statement it appeared that the prisoner had used great violence to this part of her body; yet on a careful examination, during life and after death, there were no marks of ecchymosis or contusion. The case of *Slater and Vivian* (Central Crim. Court, Sept. 1860), charged with the manslaughter of a lunatic at Colney Hatch Asylum, presents many points of importance in reference to this medico-legal question. (Winslow's Med. Critic, and Psychological Journal. No. 1. Jan. 7, 1861, p. 91.)

CHAPTER 23.

EVIDENCE OF THE USE OF A WEAPON—CHARACTERS OF WOUNDS CAUSED BY WEAPONS—INCISED, PUNCTURED, LACERATED, AND CONTUSED WOUNDS—STABS AND CUTS—WHAT ARE WEAPONS?—EXAMINATION OF THE DRESS.

Evidence of the use of a weapon.—It may happen on a criminal investigation, that a weapon is presented to a medical witness; and he is required to say whether the wound, found on the body of a person, was produced by it. When, upon the clearest evidence, it is certain that a weapon has been used, it is not uncommon for prisoners to declare that no weapon was employed by them, but that the wound had been occasioned by accidental circumstances. A witness should remember that he is seldom in a position to swear that a particular weapon produced at a trial, must have been used by the prisoner:—he is only justified in saying, that the wound was caused either by it or by one similar to it. Schwörer relates the following case. A man was stabbed by another in the face: and a knife, with the blade entire, was brought forward as circumstantial evidence against him,—the surgeon having stated that the wound must have been caused by this knife. The wounded person recovered; but a year afterwards an abscess formed in his face, and the broken point of the real weapon was discharged from it. The wound could not therefore have been produced by the knife which was brought forward as evidence against the prisoner at the trial. (Lehre von dem Kindermorde.) Although the criminality of an act is not lessened or impugned by an occurrence of this kind, it is advisable that such mistakes should be avoided by the use of proper caution on the part of a witness. (On this question, see the case of *Renaud*, by Dr. Boys de Loury, Ann. d'Hyg. 1839, t. 11. p. 170. As to what is a weapon, see Henke, Zeitschrift der S. A. 1844, vol. 1. p. 67.)

Characters of wounds produced by weapons.— Let us now suppose that no weapon is discovered; and that the opinion of a witness is to be founded only on an examination of a wound. It is right for him to know that on all criminal trials, considerable importance is attached by the law to the fact of a wound having been caused by the use of a weapon; since this often implies malice, and in most cases a greater desire to injure the party assailed, than the mere employment of manual force. Some wounds, such as cuts and stabs, at once indicate that they must have been produced by weapons.

Incised wounds.— In incised wounds, the sharpness of the instrument may be inferred from the cleanness and regularity with which the edges are cut: in stabs, also, the form and depth of a wound will often indicate the kind of weapon employed. Stabs sometimes have the characters of incised punctures, one or both extremities of the wound being cleanly cut, according to whether the weapon was single or double-edged. Dupuytren has remarked, that such stabs, owing to the elasticity of the skin, are apparently smaller than the weapon — a point to be remembered in instituting a comparison between the size of a wound and the instrument. A lateral motion of the weapon may, however, cause a considerable enlargement of the wound. (See case, Ann. d'Hyg. 1847, t. 1. p. 400.) When a stab has traversed the body, the entrance-aperture is commonly larger than the aperture of exit; and its edges, contrary to what might be supposed, are sometimes everted, owing to the rapid withdrawal of the instrument. That facts of this kind should be available as evidence, it is necessary that the body should be seen soon after the infliction of a wound, and before there has been any interference with it.

Punctured wounds.— It is necessary to notice whether the edges of a punctured wound are lacerated and irregular, or incised; because it may be alleged in defence, that the wound was produced by a fall on some substance capable of causing an injury somewhat resembling it. In a case that occurred to Mr. Watson, a deeply penetrating wound on the genital organs of the deceased, which had evidently caused the woman's death, was ascribed by the prisoners charged with the murder, to her having fallen on some broken glass; but it was proved that the edges of the wound were bounded everywhere by clean incisions, which rendered this defence inconsistent, if not impossible. I have known a similar defence made on two other occasions, where the cases came to trial. In one, a man struck the prosecutor, and knocked him against a window. On examination, there were three deep cuts on the face of the prosecutor, but no weapon had been seen in the hands of the prisoner. He was charged with cutting and stabbing. The surgeon deposed that the wounds appeared to have been inflicted with a knife or razor-blade, and not by broken glass. If the wounds had been made by glass, particles of that substance would probably have been found in them; but there were none. The prisoner was acquitted, the infliction of the wounds by a weapon not being considered to have been made out. In another case that occurred in August 1841, the prosecutor was knocked down, and his throat was found severely cut; but there was no direct proof that a weapon had been used. In the defence it was urged that the wound had been produced by a broken pane of glass; but the surgeon described it as a clean cut, five inches in length, and one inch in depth, laying bare the carotid artery. He considered that it must have been inflicted by a razor or knife; and that it was a cut made by one stroke of the instrument. In *Reg.* v. *Ankers* (Warwick Lent Assizes, 1845), a clean cut as from a penknife, about two inches long, and one deep, was proved to have existed on the person of the prosecutor, who had fallen during a quarrel with the prisoner. Some broken crockery was lying near the spot, and it was alleged in the defence that a fall upon this had caused the wound. This allegation was quite inconsistent with the clean and even appearance of the wound. The prisoner, in whose possession a pen-knife had been found, was convicted.

In general, wounds made by *glass or earthenware* are characterized by their great irregularity and the unevenness of their edges. Cases of this kind show that as it is not always possible to know when this sort of defence may be raised, a medical witness should never fail to make a *minute examination* of a wound which is suspected to have been criminally inflicted. A trial for murder took place at the Worcester Summer Assizes, in 1838, in which it appeared in evidence that the deceased had died from a small punctured wound in the thorax. It was five inches and a half deep; it had completely traversed the right ventricle of the heart, and had led to death by hæmorrhage. The wound was supposed to have been produced by a small skewer, which was found near the spot: but in the defence it was alleged that the deceased had fallen over a tub, and that the wound had been caused by a projecting nail. This allegation, however, was negatived by the surgeon, from the fact of its being a clean *cut* wound. Had it been produced in the manner alleged by the prisoners, the fact would have been indicated by an irregularity of margin. In the case of *Bryant* (Taunton Lent Assizes, 1849), which involved a charge of maliciously stabbing the prosecutor, the defence was that, as many flints were lying about in the road, and the assault took place in the dark, the wound might have been inflicted accidentally during a fall. The medical witness could not say that the wounds had been positively caused by a weapon: they might have been produced by the flints. The prisoner was acquitted. A careful examination made at the time of the injury would most probably have enabled the witness to give a positive opinion, instead of leaving the case open to doubt. A puncture made by a flint during a fall is not likely to resemble a stab with a knife. The wound would present some marks of laceration and great irregularity. As the wound was under the ear, it was by no means probable from the situation that it could have been thus caused accidentally.

In January 1853, Mr. Hancock was enabled, by the careful examination of a wound, to disprove a charge of maliciously wounding made against innocent persons. A little girl was represented to have received, while sitting over an iron grating, a wound in the pudendum, by some persons pushing a toasting-fork, or pointed instrument, between the bars of the grating. There were no marks of punctures, which would have been found had this statement been true, but a slight laceration of the parts, such as might have been produced by an accidental fall on the edge of the grating while the girl was in a sitting position. There were also marks of bruises on the thigh, such as would have occurred from an accident of this kind. The mother of the child had made a false charge for the sake of exciting public compassion and procuring money. A proper examination of the injury clearly established that it had resulted from accident. The part of the body in which the injury existed in this case is not usually exposed to lacerations or punctures from accident; but the child, for a certain purpose, had placed herself voluntarily in this position, and had, on her own admission, slipped, and thus probably injured herself.

Lacerated and contused wounds.—Lacerated wounds do not in general present greater difficulty with regard to their origin than those which are incised or punctured. The means which produced the laceration are commonly well indicated by the appearance of the wound. These injuries are generally the result of accident: they are, however, frequently met with on the bodies of new-born children, in which case they may give rise to charges of infanticide. *Contused* wounds and severe contusions present much greater difficulty to a medical jurist. It is not often in his power to say whether a contused wound has resulted from the use of a weapon, from *a blow of the fist*, or *a fall*, by reason of the deceased having accidentally fallen against some hard surface. The question is frequently put to medical witnesses, on those trials for manslaughter which arise out of the pugilistic combats of half-drunken men. One of the combatants is generally killed, either by a blow on the head, by a fall, or by both kinds of violence combined. The skull may or may not be fractured; and the person may die of concussion, inflammation of the brain, or from effusion of blood. The general defence is that the deceased struck his head against some hard substance in falling on the ground; and the surgeon is asked whether the particular appearances might not be explained on the supposition of a fall. This, in general, he admits to be possible, and the prisoner is acquitted. A medical witness is rarely in a position to swear with certainty, that a contused wound of the head must have been produced by a weapon and not by a fall. Some circumstances, however, may occasionally enable him to form an opinion on this point. If there are contused wounds on several parts of the head, with copious effusion of blood beneath the skin, the presumption is that a weapon must have been used. If the marks of violence are on the summit of the head, it is highly probable that they have been caused by a weapon, since this is not commonly a part which can receive injury from a fall. According to the medical evidence given on this question, an indictment may or may not be sustained. A case is reported in which a prisoner was indicted for striking the deceased, and fracturing his skull with a piece of brick. The evidence showed that the prisoner struck with his fist, and that the deceased in consequence fell upon a piece of brick, which caused the fracture and led to his death. The judges held that this was a fatal variation. (Law Times, Mar. 21, 1846, p. 501.) Technicalities of this kind will probably be set aside in future under the statute 14 and 15 Vict. c. 100; and indeed, in one case (*Reg.* v. *Dodd*, Shrewsbury Summer Ass. 1853), Coleridge, J., is reported to have expressed a strong opinion against the distinction thus made respecting the cause of the injury. The prisoner, it was alleged, threw a stone at the deceased, who immediately fell on a stone floor. The deceased was able to go about for several days, but he died, a week after he had sustained the violence, from inflammation of the brain, as a result of fracture of the skull. The medical witness referred the fracture to a blow from a stone. In the defence it was urged that the fracture might just as well have arisen from a fall on the stone floor. Coleridge, J., is reported to have said, that if the prisoner knocked the deceased down, it would make no difference whether the deceased died from a fall on the stone floor or whether a stone was thrown at him.

A doubt may arise whether a *weapon* has or has not been used in reference to lacerated or contused wounds. Contused wounds on bony surfaces, as on the head, sometimes present the appearance of incised wounds, the skin being evenly separated; still when a wound is recent, a careful examination will generally enable a witness to form a correct opinion. If some time has elapsed before the wound is examined, great caution will be required. In some instances an accurate observation of the form of a wound, and a comparison of it with the supposed weapon, will justify a medical witness in giving a strong opinion on the point. The depth and nature of the wound may be such that no accidental fall would reasonably account for its production. A case of considerable importance in reference to this medico-legal question was tried at the Cornish Assizes, 1851; for a report of which I must refer the reader to the Medical Gazette, vol. 48. p. 729. (*Reg.* v. *Teague*, Cornwall Summer Assizes, 1851.)

Stabs and cuts.—It has been remarked, that the law in some cases attaches great importance to the clear proof of the use of a *weapon;* and a medical man has therefore a serious responsibility thrown upon him when, in the absence of a weapon or of evidence of its use, he is called upon to say, from an examination of the wound, whether one has or has not been used. The statute on wounding makes no difference in respect to the means by which wounds are inflicted; but the words have been hitherto held by the judges to imply, in all cases, the use of some *weapon* or instrument. The following are the provisions of the law:—"Whosoever shall stab, cut, or wound any person, or shall, by any means whatsoever, cause to any person, any bodily injury dangerous to life, with intent in any of the cases aforesaid to commit murder, shall be guilty of felony." (1 Vict. c. 85, s. 2.) The word *stab* has been held to import a wound from a pointed instrument; the word *cut*, from an instrument having an edge; and the word *wound* comprises incised, punctured, lacerated, contused, and gunshot wounds: thus including all stabs and cuts, and medically speaking, rendering the separate use of these words in the statute wholly unnecessary. All medical men know that stabs and cuts are varieties of wounds; and it is difficult to understand why these terms should have been retained, and the other varieties of wounding, as "incise, puncture, lacerate, and contuse," omitted. It was formerly held that an indictment for cutting would not be supported if the medical evidence proved that the alleged cut was a stab, and *vice versâ;* and further, in an indictment for cutting and stabbing, it was not considered sufficient to prove that it was a contused or lacerated wound. Again, some doubt existed regarding the meaning of the word *weapon*. Thus the teeth, the hands or feet uncovered, were held by the majority of the judges not to be weapons; and injuries produced by them, however severe, were not treated as wounds within the meaning of the statute. Parties were tried on charges of biting off fingers and noses, and although the medical evidence proved that great disfigurement and mischief had been done to the prosecutor; yet the nature of the injury produced—the division of the cutis—was not so much regarded as the actual method by which it was accomplished. The persons charged were acquitted under an indictment for "wounding." From a trial which took place at the Nottingham Assizes in 1832, it appeared, however, that artificial arms and legs were not exempted under the statute. In the case alluded to, a strenuous effort was made by the prisoner's counsel to show that a wooden arm with which an assault was committed had become, by long use, part of the body of the prisoner, and that like a natural arm, it ought not to be considered a weapon in law! The objection was overruled.

Within a recent period a great improvement has taken place in this part of our criminal law. The technicalities which arose out of the necessity of strictly defining the nature of a wound, and whether it had or had not been caused by a weapon, are now in great part removed by the 14 and 15 Vict. c. 19, sec. 4. It is herein provided that punishment shall follow the conviction of a person who has inflicted grievous bodily harm, whether with or without any weapon or instrument, or who has maliciously cut, stabbed, or wounded any person. A man has been tried under this statute, for biting off part of the nose of another; and in another case a man was convicted of maliciously maiming by biting off a large piece of the tongue of the prosecutor. The old objection that the teeth are not weapons, cannot now be raised in defence. The 14 and 15 Vict. c. 100, is also adapted to meet those cases in which trivial technical objections are raised to the description of wounds in an indictment and of the circumstances under which they have been inflicted.

Examination of the dress.—The use of a weapon on these occasions may be sometimes inferred from the dress having been cut; although it is quite possible that a contused wound may be inflicted by a bludgeon through the dress, without tearing or injuring it. The perforation of the dress is by no means necessary for the production of considerable laceration of the skin and muscles, supposing the article of dress to be at all of an elastic or yielding nature. In stabs or cuts with sharp pointed instruments, the part of the dress covering the wound should present marks of having been perforated or cut by a weapon. In self-inflicted or imputed wounds, this is one character by which the correctness of a statement may be tested (See IMPUTED WOUNDS). A wound may be indirectly produced by a weapon, and medical witnesses have been often questioned on this point. Thus, the prosecutor may at the time have worn about his person some article of dress which received the blow, and this may have caused the wound. On a trial for maliciously wounding, which took place at the Reading Spring

Assizes in 1837, it appeared in evidence, that the prisoner, while poaching, assaulted a gamekeeper by inflicting on his head severe blows with a gun. At the time of the assault, the prosecutor wore a strong felt hat, which, it was contended in defence, had caused the wounds that formed the subject of the charge. The medical witness admitted that the wounds might have been produced either by the hat or the gun. The prisoner was convicted; but the judge intimated a doubt whether this could be considered a "wounding by a weapon" within the statute. In another case, a blow was struck with a bludgeon at the head of the prosecutor, who wore spectacles. Wounds were produced, which it was argued in the defence, had resulted from the glass of the spectacles. The prisoner was acquitted. Every case of this kind must be determined according to the circumstances accompanying it. One fact appears to me to be well established from the foregoing cases, — namely, that a medical practitioner should always make a minute and careful examination of wounds which are likely to become the subject of criminal charges. In performing his duties as a surgeon, he is bound, so far as he consistently can, to notice as a medical jurist the characters of all personal injuries.

I am indebted to Mr. Codd, coroner for Essex, for an instructive case, which occurred in August 1853, showing the importance of comparing the article of dress with the injuries which may have proved fatal. A woman, æt. sixty, was found dead in her bed. She had vomited slightly, and there was a small quantity of blood on the floor, which had flowed from the nose. She had been seen in her usual health on the previous night. On inspection, there were found two indentations about the middle of the right parietal bone, and there was a large clot of blood in this situation beneath the skin. On removing this clot, the bone was found fractured to the extent of four inches. Nearly three ounces of dark clotted blood were found on the outer membrane of the brain (dura mater), between it and the skull. All the other viscera were healthy. This was the only injury, and quite sufficient to account for death: but a question arose respecting the mode in which this fracture was caused. It was in evidence that, on the evening before her death, deceased had been suddenly knocked down, while she was walking in a public road, by a man accidentally running against her. One witness stated that she fell heavily on the back of her head, on which at the time she wore a bonnet. She appeared stunned, — was raised up by the men,— some brandy was given to her, and she recovered sufficiently to walk home and eat her supper as usual, after which no one saw her until she was found dead the following morning. Some suspicion arose that the violence done to the head was too great to be accounted for by the mere fall, and it was a question whether, with such an amount of injury, the deceased could have walked to her home, at the distance of a mile and a half. At first it was thought that this was a case of murder, and a man who lodged in the house with deceased, was suspected. His room was searched, and a hammer with two claws was found. On comparing these claws with the two indentations and fracture, this weapon appeared to account for their production. Deceased and this man had been in the habit of quarrelling, and they were the only persons in the house on this occasion. The lodger said that he let the woman in about 9 o'clock (the fall in the road occurred about 7·30); her appearance presented nothing unusual, and he saw no more of her until called at 7 the next morning, when she was found dead and cold. At the adjourned inquest, the bonnet worn by the deceased at the time of the fall was called for by the coroner. Two indentations were found upon the back part of it corresponding to those on the skull of deceased. The indentations on the bonnet contained dust and dirt, thereby confirming the statements of the witnesses, and rendering it probable that the fall had caused the injury.

The examination of the dress, in this case, cleared up what might have been otherwise doubtful. It is probable that the large internal effusion of blood which caused death did not take place until deceased had reached home, and perhaps as a result of the exertion made. She must have died very soon after she went to bed, as her body was found cold at 7 o'clock the next morning. In addition to the caution which this case conveys respecting medical opinions on the origin of wounds, it shows that persons may walk and die at a great distance from the spot where a serious injury to the head has been sustained.

CHAPTER 24.

WOUNDS INDICATIVE OF HOMICIDE, SUICIDE, OR ACCIDENT—EVIDENCE FROM THE SITUATION OF A WOUND—SUICIDAL WOUNDS IN UNUSUAL SITUATIONS—EVIDENCE FROM NATURE AND EXTENT—SHAPE—EVIDENCE FROM THE DIRECTION OF A WOUND—WOUNDS INFLICTED BY THE RIGHT OR LEFT HAND—ACCIDENTAL AND HOMICIDAL STABS—EVIDENCE FROM THE PRESENCE OF SEVERAL WOUNDS—THE USE OF SEVERAL WEAPONS—TWO OR MORE MORTAL WOUNDS—WOUNDS PRODUCED SIMULTANEOUSLY OR AT DIFFERENT TIMES.

Wounds indicative of homicide, suicide, or accident.—Supposing that the wound which is found on a dead body is proved to have been caused before death, it may be necessary to inquire whether it was the result of *suicide*, *homicide*, or *accident*. It might at first sight be considered that the determination of a question of this nature was wholly out of the province of a medical jurist. In some instances it may be so, and the settlement of it is then properly left to the legal authorities; but, in a large number of cases, it is so closely dependent for its elucidation on medical facts and opinions, that juries could never arrive at a satisfactory decision without medical evidence. Let us suppose, then, that a medical jurist is consulted in a doubtful case,—What are the points to which he must direct his attention? These are, with regard to the wound, 1, its *situation*, 2, its *nature and extent*, and, 3, its *direction*.

1. *Evidence from the situation of a wound.*—It is a general principle in which most medical jurists agree, that wounds, inflicted by a suicide, are usually confined to the fore or lateral parts of the body. The throat and chest are commonly selected, when cutting instruments are employed: while the chest, especially in the region of the heart, the mouth, the orbit and the temples, are the spots generally chosen for the perpetration of suicide by fire-arms. But it is obvious, that any of these parts may be also selected by a murderer, with the especial design of simulating a suicidal attempt; therefore the mere situation of a wound does not suffice to establish the fact of suicide. Dr. Smith considers, in reference to pistol-wounds, that if the weapon has been introduced into the deceased's mouth and there discharged, we may also take it for granted that "it has not been done by another" (For. Med. p. 302); but this inference has been rather too hastily drawn, because it is quite within the range of possibility, that a cool and calculating assassin may purposely resort to this method of destroying a person in order to conceal the crime. In suicidal wounds from fire-arms, a discolouration by powder of the fingers of the hand which discharged the weapon is sometimes observed; this has also been looked upon as a source of evidence of suicide under doubtful circumstances, but a similar objection, although not with equal force, might be made to its admission. Some have regarded it as fully established in legal medicine, that when wounds exist at the back part of the body, it is a positive proof that they have not been self-inflicted. This situation is certainly unusual in cases of suicide; but, as Orfila observes, it is not the situation, so much as the direction of a wound, which here furnishes evidence against the presumption of suicide. A wound, traversing the body from behind to before in a direct line, is not likely to have resulted from a suicidal attempt; at least, it must be obvious that it would require more preparation and contrivance on the part of a self-murderer, so to arrange matters, that

such a wound should be produced, than we can believe him to possess at the moment of attempting his life. Besides, his object is to destroy himself as quickly and as surely as circumstances will permit; he is, therefore, not likely to adopt complicated and uncertain means for carrying this design into execution. Nevertheless, we must not always expect to find suicidal wounds in, what a surgeon would pronounce to be, the most appropriate situation to produce instant destruction. A want of knowledge, or a want of resolution on the part of a suicide, or the accidental slipping of the hand, will often cause a wound in a part where we might least expect to find it.

Wounds which result from accident or suicide are generally in *exposed* parts of the body. An incised wound in a concealed or not easily accessible part is presumptive of murder: because this kind of injury could have resulted only from the deliberate use of a weapon. Suicidal wounds are, however, sometimes found in the most unusual situations. In December, 1842, a surgeon destroyed himself by cutting through the brachial artery and the principal veins of his left arm with a penknife: and in another instance, which occurred in 1839, a young man committed suicide by dividing the arteries of the fore-arm on both sides. It is very rare that we find suicidal stabs in the abdomen or throat, but an instance occurred a few years since, in which a woman destroyed herself by a stab in the lower part of the abdomen; and several similar cases are recorded by medico-legal writers. In an attempt at suicide, which fell under my own observation, a stab was inflicted by a carving knife on the fore part of the neck traversing the parts from the windpipe to spinal column. In regard to situation, it has been remarked, that there is no wound which a suicide is capable of inflicting upon himself, which may not be produced by a murderer; but there are many wounds inflicted by a murderer, which from their situation and other circumstances, a suicide would be incapable of producing on his own person. We cannot always obtain certainty in a question of this kind: the facts will often allow us to speak only with different degrees of probability. A remarkable instance of the singular situation selected for suicidal wounds is reported in the Medical Gazette, vol. 45. p. 439.

The situation of a wound sometimes serves to show whether it is of an *accidental* nature or not,—a point often insisted on in the defence. Accidental wounds generally exist on those parts of the body which are exposed. Some wounds, however, forbid the supposition of accident even when exposed; as deeply incised wounds of the throat, and gunshot wounds of the mouth and temples. For the report of a case in which an accidental wound on the head, by an axe, closely simulated a homicidal wound, see Casper's Wochenschrift, May 24, 1845.

2. *Evidence from the nature and extent of a wound.*—Generally speaking, the wound met with on the body of a suicide, when fire-arms have not been used, is incised or punctured. Contused wounds are rarely seen in cases of suicide, because in producing them there is not that certainty of speedily destroying life to which a self-murderer commonly looks. There are, of course, exceptions to this remark; as where, for instance, a man precipitates himself from any considerable height, and is wounded by the fall. Circumstantial evidence will, however, rarely fail to clear up a case of this description. Greater difficulty may exist when life is destroyed by a contused wound, voluntarily inflicted. A case is related by a medico-legal writer in which a man first attempted to destroy himself by running with his head against a wall; and not having succeeded in this attempt, he struck himself repeatedly on the forehead with a cleaver. By this he produced such violent injury to the brain, that death soon followed. The man was seen to commit the crime by several witnesses: had not this been the case, the nature of the wound was such as to excite suspicion that it had been inflicted by another, and that the man had been murdered.

A close attention to the *shape* of wounds made by cutting instruments will sometimes lead to the development of cases rendered doubtful from the circumstances under which the dead body of a wounded person is found. A few years since, the body of a farmer was found lying on a high road, in one of the midland counties. The throat was severely cut, and he had evidently died from the bleeding which had taken place. A bloody knife was discovered at some distance from the body, and this, together with the circumstance of the pockets of the deceased having been rifled, led to a suspicion of murder. The suspicion was confirmed when the wound in the throat was examined by a surgeon. It was cut, not, as is usual in suicides, by carrying the cutting instrument from before backwards, but as the throats of sheep are cut, when slaughtered by a butcher. The knife had been passed in deeply under and below the ear, and been brought out by a semicircular sweep in front, all the great vessels of the neck, with the gullet and windpipe, having been divided from behind forwards. The nature of this wound rendered it at once improbable that it could have been self-inflicted; and it further served to detect the murderer, who was soon afterwards discovered. The prisoner, who was proved to have been a butcher, was subsequently tried and executed for the crime.

When persons labouring under insanity commit suicide, they often inflict upon themselves wounds of an extraordinary nature,—such as would, at first view, lead to a suspicion that they had been produced by the hand of a murderer: and, therefore, the rules which are here laid down to distinguish homicidal from suicidal wounds, must be guardedly applied to the cases of those individuals who are known to have been insane. A gentleman was found lying in a state of insensibility in the kitchen of his house, with a cleaver by his side. On examining the head, upwards of thirty wounds were found over the posterior portion of the occipital bone. The wounds, many of which were superficial, had a horizontal direction from behind forwards. One, however, had removed a portion of the skull from the middle of the lambdoidal suture, so that the brain had escaped. This person, who was a lunatic, died four days afterwards, but recovered so far as to admit that he had produced the wounds on himself, of which, from other circumstances, there could be no doubt. This was a most unusual mode of committing suicide. Had the deceased been found dead on a public highway, thus wounded, it is probable that a suspicion of murder would have arisen. In 1850, a case occurred at Guy's Hospital, in which a person in a fit of delirium tore away the whole of the abdominal muscles from the lower and fore part of the abdomen. Had the body of this person been found dead with such an unusual and serious personal injury, it is not improbable that it would have been pronounced homicidal and not suicidal. In this point of view, a case which occurred to Dr. W. B. Ryan is also of interest. The suicide here contrived to cut his throat exactly between the os hyoides and the larynx, having previously made two distinct cuts on the thyroid cartilage. The wound was of an extensive kind, reaching backwards through the pharynx to the cervical vertebræ, one of which had been touched by the razor. The carotids and jugulars had escaped, but some of the larger branches were divided. The man survived about seven hours. (Med. Times, Jan. 17, 1852, p. 73. For another case of extensive wounds in the throat by a lunatic, see Med. Times and Gazette, August 27, 1853, p. 219.) Cases of this kind should be borne in mind, when we are called upon to speak to the *possibility* or *impossibility* of certain wounds found on a dead body, having been self-inflicted. (Med. Gaz. vol. 24, p. 276.)

The *extent* of a wound, by which we are to understand the number and importance of the parts injured, must in these cases be always taken into consideration. It has been somewhat hastily laid down as a rule, that an extensive wound of the throat, involving all the vessels and soft parts of the neck to the vertebral column, could not be inflicted by a suicide. Although, in general, suicidal wounds of this part of the body do not reach far back, or involve the vessels of more than one side, yet we find occasionally that all the soft parts are completely divided to the vertebral column. These are cases in which, perhaps, with a firm hand, there is a most determined purpose of self-destruction. In a case of suicide, observed by Mare, the weapon had divided all the muscles of the neck, the windpipe, and gullet,—had opened the jugular veins and both carotid arteries,—and had even grazed the anterior vertebral ligament. A wound so extensive as this, is rarely seen in cases of suicide; but there is no ground for the assertion, that such extensive wounds in the throat are incompatible with self-destruction.

Incised wounds in the throat are generally set down as presumptive of suicide; but murderers sometimes wound this part for the more effectual concealment of crime. Circumstances connected with the form and direction of a wound, often, in such cases, lead to detection; for, unless the person attacked be asleep or intoxicated, resistance is offered,—evidence of which may be obtained by the presence of great irregularity in the wound, or the marks of other wounds on the deceased. In some instances, however, it is extremely difficult to say whether the wound is homicidal or suicidal,—the medical facts being equally explicable on either hypothesis. (See case by Mare, Ann. d'Hyg., 1830, t. 2. p. 408; another by Devergie, ib. 414; and a third by M. Ollivier, Ann. d'Hyg., 1836, t. 1. p. 394.)

The nature and extent of a wound or of other injuries on the person, will sometimes allow us to distinguish *accident from homicide*. These personal injuries may be such, that they could not possibly have had a suicidal or accidental origin. In a case that occurred at Manchester, in October 1836, it was shown by the medical evidence, that seven ribs were fractured on one side of the chest of the deceased, and five on the other. The person charged with murder alleged in defence, that he had merely struck the deceased a slight blow, and that the ribs were broken subsequently by an accidental fall. The medical witness, however, satisfied the Court that the fall, as described by the prisoner, was inadequate to the production of such extensive violence; and that even had the deceased fallen on *one* side this would not account for the fracture of the ribs on the *other*. When, therefore, we find in a dead body, severe injuries referred to a fall, we should search the whole of the body carefully for marks of violence. The insides of the arms or thighs might present marks of injury, which could not possibly be explained on the supposition of an accidental fall. Severe contusions on both sides of the body, or anteriorly and posteriorly, commonly indicate homicidal violence.

3. *Evidence from the direction of a wound.*—The direction of a wound has been considered by some to afford presumptive evidence sufficiently strong to guide a medical jurist in this

inquiry. It has been remarked that in most suicidal wounds which affect the throat, the direction of the cut is commonly from left to right, either transversely or passing obliquely from above downwards: in suicidal stabs and punctured wounds, the direction is commonly from right to left, and from above downwards. In left-handed persons, the direction would, of course, be precisely the reverse. Suicidal wounds are, however, subject to such variation in extent and direction, that it is scarcely possible to generalize with respect to them. Nevertheless, an attention to these points may sometimes be of real assistance to the inquirer, especially when the body has not been moved from its position. It is recommended that the instrument with which the wound has been inflicted should be placed in either hand of the deceased, and the extremity moved towards the wounded part, so that it may be clearly seen whether the direction of the wound could or could not correspond to it in any position. It might happen that neither arm would reach the wounded part, so as to inflict a wound of the particular direction observed: this may be the case in wounds situated on the back. It is obvious that if a murderer makes an incised wound in the throat from behind, the direction will be the same as that commonly observed in cases of suicide. (See on this point the case of *Reg.* v. *Dalmas*, Cent. Crim. Court, May 1844.) Again, if the person attacked is powerless the wound may be deliberately made, so as to simulate a suicidal act; indeed murderers would seldom attack the throat, but with the design of simulating an act of suicide. A homicidal stab may also take the same direction as one which is suicidal; but this would be confined to those cases in which the murderer was placed behind or aside. If in front of the person whom he attacks, the direction would probably be from left to right; but in suicide, when the right hand is commonly used, it is the reverse. Oblique wounds, passing from above downwards, are common to homicide and suicide; but those which take an oblique course from below upwards are generally indicative of homicide; it is at least extremely rare, that a suicide, unless a lunatic, thus uses a weapon. Homicidal incisions, especially in the throat, are often prolonged below and behind the skin forming the angles of a wound, deeply into the soft parts. Those which are suicidal rarely possess this character; they terminate gradually in a sharp angle, and the skin itself is the furthest point wounded,—the weapon is not carried either behind, below, or beneath it. Exceptions to these characters may exist; but in a dark and intricate subject of this nature, we have only these limited rules to guide us. The instrument with which a wound is supposed to have been inflicted should be adapted to the edges of the incision: its sharpness compared with the cleanness and evenness of the cut, and its length with the depth of the incision or stab. It is no uncommon occurrence for a murderer to substitute some instrument, belonging to the deceased or another person, for that which he has employed; and this by its size, shape, or bluntness, or other peculiarities, will not account for the appearances presented by the wound.

Wounds inflicted by the right or left hand.—Some remarks have been made in reference to the direction of a cut or a stab varying according to whether the right or the left hand has been used by a suicide. It is necessary for a medical jurist to be aware, that there are many persons who are *ambidextrous*, *i. e.* who have equal facility in the use of the right or the left hand. This may not be generally known to the friends of the deceased: and such persons are often pronounced, even by those who have associated with them, to have been right-handed. A want of attention to this point is said to have been one of the circumstances which led to a suspicion of murder in the case of *Sellis*. (Wills' Circ. Evidence, p. 97.) He was found dead on his bed with the throat cut,—the razor was discovered on the left side of the bed; whereas it was generally supposed and asserted that he was a right-handed man. The truth was, he was ambidextrous,—equally expert in the use of the razor with his left and right hand; and thus the apparently suspicious circumstance of the razor being found on his left side, was at once explained away.

Accidental stabs.—Severe incisions on vital parts do not often happen by accident; but severe punctures and stabs affecting vital organs have frequently an accidental origin. These stabs arise generally from falls, while the person is in the act of running with a pointed instrument in his hand or his pocket. There is one character which, when thus produced, they are commonly observed to possess, namely, that their direction is from below upwards. In this way the truth of a defence may be sometimes tested, as when a prisoner alleges that the deceased threw himself or fell upon the weapon. Homicidal stabs may be likewise directed from below upwards; but this is somewhat rare, and not probable, unless the person is stabbed by an oblique blow, while in the recumbent posture. Rules of this kind may appear to be susceptible of but little practical application; yet cases occasionally present themselves, wherein a close attention to situation and direction may materially assist a medical jurist in forming an opinion. In a case of alleged murder, which was tried in 1843 at the Central Criminal Court, the surgeon deposed, that he found on examining the body of the deceased, a stab on the left side of the chest, near the armpit, about six inches in depth. It had wounded the right lung, and had penetrated obliquely into the right auricle of the heart, passing from left to right. He contended, very properly, that, considering the situation and direction of the wound, it was very improbable that the deceased could have inflicted it upon himself. The fact that there may be some instances in which rules of this kind will not be applicable, must not deter us from endeavouring to make a cautious application of them in doubtful cases.

At the trial of a *Mrs. Mackinnon* for murder (1823), a careful observation of the direction of a stab in the chest clearly proved the falsehood of the defence. The deceased had been stabbed with a knife, and on an inspection of the body it was found that the wound, which was situated over the cartilage of the second left rib, penetrated towards the left, backwards, and very much downwards, into the lungs. On the part of the prosecution it was alleged that the prisoner held a long table-knife daggerwise, drew a blow from her left ear, and struck the deceased in a direction downwards, forwards, and to her right side. The prisoner alleged in defence that she merely held the knife before her, sloping upwards, to deter the deceased from attacking her; that he stumbled forward, and fell upon the point of the knife. This statement was in some measure confirmed by some bystanders. As the witnesses on both sides were intoxicated and of disreputable character, the important medical fact to guide the jury was the *direction* of the wound. This was wholly inconsistent with the statement of the prisoner, but perfectly in accordance with the evidence for the prosecution. (Ed. Monthly Journal, Nov. 1851, p. 418.)

The presence of several wounds.—In suicides, commonly, one wound only is seen, namely that which has destroyed life; and the presence of several wounds on the body, or the marks of several attempts around the principal wound, have been considered to furnish presumptive evidence of murder. But any inferences of this kind must be cautiously drawn, since not only may a murderer destroy his victim by one wound, but a suicide may inflict many, or leave the marks of several attempts, before he succeeds in his purpose. A case is reported in which a gentleman, labouring under mania, attempted to destroy himself. Besides many wounds on the fore-arm, neck, and face, which disfigured him, there were twenty-two in front of his chest. One of these had traversed the heart, producing death after some hours, by causing effusion of blood. (Lancet, July, 1839.) In wounds of the throat, owing to ignorance of the situation of vital parts, or to tremulousness of the hand, a suicide often produces one or more incisions of greater or less extent near that which may have destroyed him. This is especially the case when the instrument happens to lodge in the first instance on the cartilages of the larynx. The same remark applies to suicidal stabs, when the point of a weapon, in being directed against the chest, comes first in contact with the ribs or their cartilages. With respect to the throat, many cases might be cited in which, two, three, and even six or more incisions, have been made in this part by suicides before they have destroyed themselves. A case occurred to Dr. Handyside (Ed. Med. and Surg. Jour. Jan. 1838), in which a medical man destroyed himself by inflicting several wounds on his throat. Incisions were found on each side, just below the angle of the jaw and in the hollow behind it. They were irregular in form, and bore the character of deep stabs. The only important vessel divided was the internal jugular vein on the right side; but, nevertheless, a large quantity of blood was lost, and this was, no doubt, the real cause of death. The case is in many points of view singular; for such wounds, so far as I know, have never before been found in cases of suicide. It would appear that the deceased was ambidextrous, and that the wounds on each side of the neck were inflicted by the hand of the opposite side. The following case, which occurred in London in 1839, is somewhat similar:—A lady, who had been for several days in a desponding state, was found one morning dead in her bed in a sitting posture. On examination, two very deep and extensive wounds, which had divided the principal blood-vessels, were perceived on the right side of the neck. There were two penknives on the bed covered with blood. From the situation and other characters of the wounds, it was inferred that they must have been inflicted with the left hand: although nothing satisfactory could be ascertained on this point. The husband and son slept in the adjoining room. There was no doubt that this was a case of suicide; although it is singular that two deep wounds should have been found thus inflicted by two different weapons on the right side of the neck, in the case of a person who was not known to be left-handed.

The use of several weapons.—In general, suicides, when foiled in a first attempt, continue to use the same weapon; but sometimes, after having made a severe incision in the throat, they will shoot themselves, or adopt some other method of self-destruction. These cases can only appear complicated to those who are unacquainted with the facts relative to self-murder. Neither the presence of several wounds by the same kind of weapon, nor of different wounds by different weapons, can be considered, of themselves, to furnish any proof of the act being homicidal. One instance has been already related, in which a lunatic, in committing suicide, inflicted *thirty* wounds upon his head. In a case of murder, when many wounds are found on a dead body, it may happen that the situation or direction of some will be incompatible with the idea of a suicidal origin. Thus a stab or cut may be close to a contusion or contused wound, and although a fall or other accident might account for the latter, the former would indicate violence separately inflicted.

Two or more mortal wounds.—When we find several wounds on the body of a suicide, it generally happens that one only bears about it a *mortal* character; namely, that which has caused death. On this account it has been asserted by some medical jurists, that when two mortal wounds are found upon a body, and particularly if one of them is of a stunning or stupefying tendency (*i. e.* affecting the head), they must be considered incompatible with suicide. An inference of this kind can be applied to those cases only in which the two wounds, existing on different parts of the body, were likely to prove immediately fatal. It must, however, be borne in mind, that all suicides do not *immediately* perish from wounds which are commonly termed mortal; on the contrary, they have often the power to perform acts of volition and locomotion, which might by some be deemed wholly incompatible with their condition. It is difficult to say whether one wound was likely to destroy life so rapidly as to render it impossible for the person to have inflicted another upon himself: but when there are several distinct incisions on the throat, each involving important blood-vessels, there is good reason to infer that they have resulted from an act of murder. There are no rules by which, in unknown cases, the instantaneous mortality of wounds can be accurately determined,—a fact which will be apparent hereafter, from a description of wounds of the head, heart, and throat.

It is not possible to say, from the mere discovery of marks of contusion or injury on the head, that the deceased must have necessarily laboured under insensibility or concussion, and have therefore been afterwards unable to inflict any other wound upon himself. Injuries of the head are attended with the most singular anomalies in this respect. One person will be rendered insensible and powerless by a blow which may leave scarcely any appreciable marks, while another will be able to walk and exert himself when the skull has been fractured and depressed, blood effused, and even when a portion of brain has been lost: in short, the appearances may be such as to induce many surgeons to express an opinion that death must have taken place instantaneously. It is quite right that a medical jurist should be fully prepared for the occurrence of such anomalous cases; but a strong suspicion of homicide may fairly exist, when, besides marks of great injury to the head, a severe cut or stab is found on the body. A man is not likely to cut or stab himself after having sustained severe violence to the head; but it is quite possible that he may have had the power of precipitating himself from an elevated spot, and thereby of producing great injury to the head, after having previously attempted to cut his throat or to stab himself.

Wounds produced simultaneously or at different times.—When several wounds are found on a dead body, the question is frequently asked,—*Which was first received?* If one is what is commonly called mortal, and the others not, it is probable that the latter were first inflicted. This remark applies both to cases of homicide and suicide; but it is apparent that when, in a murderous assault, a person has been attacked by several assailants at once, the wounds may have been simultaneously produced. This is, however, a question to which it is not easy to give a general answer. Each case must be decided from the special circumstances attending it; and in most instances, unless some direct evidence is forthcoming, a medical opinion can be little more than conjectural. I here refer to it, because it is a question almost always put in a court of law; and a witness should at least prepare himself to meet it, by a proper examination of the medical circumstances of the case.

The case of *Reg.* v. *Spicer* (Berks Lent Assizes, 1846) affords an illustration of the importance of examining wounds minutely, as well as the locality where a dead body is found. The prisoner was charged with the murder of his wife, and the evidence against him was chiefly circumstantial. The deceased was found dead at the foot of a stair, as if she had accidentally fallen. The parietal bone was fractured, and the fracture had extended to the base of the skull. The brain was lacerated, and there was great effusion of blood. The second vertebra of the neck was fractured, and the spinal marrow torn through. These injuries were quite sufficient to account for death: and had they existed alone, there might have been no reason to charge the husband with the murder. But there was a wound on each temple, partly lacerated and partly bruised, and a branch of the right temporal artery had been divided,—this injury having been inflicted, apparently, with a pointed blunt instrument. There were marks of blood on the wall at the top of the staircase, and a pointed stone, covered with blood, was found near the body. It was therefore obvious, as the deceased had fallen on the summit of the head, that the injuries to the two temples *laterally*, could not have been accidentally produced, for there was no projecting body against which she could have fallen in her descent: and when the force of the fall had been spent on the head, her body could not have rolled over, so as to produce punctured and lacerated wounds on both temples. All the facts tended to show that a murderous assault had been made upon her at the top of the stair, and that she had afterwards fallen or had been pitched headlong backwards. The injuries received previous to the fall might have stunned her, and might not have sufficed to account for death: but their nature and situation furnished strong proof that they could not have arisen from any causes operating simultaneously, and that they were neither of accidental nor suicidal origin. The prisoner was convicted and executed. (Med. Gaz. vol. 37. p. 610.)

If several wounds have been inflicted through the *dress*, an examination of this may sometimes suffice to show which was first received. A man, in struggling with an assailant, received three stabs with a knife — two on the left elbow, and the third in the back. The latter was at about the level of the eighth rib;—it was vertical to the chest, and had clean edges. The lower margin was obtuse — the upper acute; hence it was evident that the cutting edge of the weapon had been directed upwards. It had traversed the left lung and the heart, and had caused immediate death. It was obvious, on examination, that this mortal wound had been first received, and the stabs at the elbow inflicted subsequently. These two stabs, which were slight, had divided the cloth coat and shirt, and had only grazed the skin, so that no blood had been effused. But the edges of the cuts in the cloth-coat and shirt were stained with blood; hence it was evident that they must have been produced by a weapon already rendered bloody by a previous wound. The fact was of some importance in the case, and the correctness of the medical opinion was confirmed by the evidence at the judicial inquiry. (See Ann. d'Hygiène, 1847, t. 1. p. 461.)

CHAPTER 25.

EVIDENCE FROM CIRCUMSTANCES—MEDICAL QUESTIONS—VALUE OF CIRCUMSTANTIAL EVIDENCE—THE POSITION OF THE BODY—OF THE WEAPON—THE WEAPON OR OTHER ARTICLES FOUND IN THE HAND OF THE DECEASED—EVIDENCE FROM BLOOD ON WEAPONS—MARKS OF BLOOD ON THE PERSON, CLOTHES, OR IN THE APARTMENT—POSITION OF THE PERSON WHEN MORTALLY WOUNDED—EVIDENCE FROM WOUNDS ON THE DECEASED—NO BLOOD ON THE ASSAILANT—FALLACY RESPECTING MARKS OF BLOOD. ARTERIAL DISTINGUISHED FROM VENOUS BLOOD—EVIDENCE FROM THE FORM AND DIRECTION OF SPOTS OF BLOOD.

Evidence from circumstances. — In pursuing the examination of the question respecting the homicidal or suicidal origin of wounds, the attention of the reader may be called to the force of evidence which is sometimes derived from the circumstances under which the body of a person, dead from wounds, is discovered. It may be said that this is a subject wholly foreign to the duties of a medical jurist; but I cannot agree to this statement: there are few in the profession, who, when summoned to aid justice by their science, in the detection of crime, do not seek for circumstances by which to support the medical evidence required of them. A practitioner would certainly be wrong to base his professional opinion exclusively on circumstantial proofs: but it is scarcely possible for him to avoid drawing an inference from these, as they fall under his observation. His evidence may be of itself weak, and insufficient to support the charge against an accused party; in such a case, if any suspicious circumstances have come to his knowledge, he may be often unconsciously induced to attach greater importance to the medical facts than he is justified in doing: in short, he may, through a feeling of prejudice, which it is not always easy to avoid, give an undue force to the medical evidence. But if a proper degree of caution is used in drawing inferences from the circumstantial proofs, and they are not allowed to create a prejudice in his mind against the accused, a practitioner is, I think, bound to observe and record them: for being commonly the first person called to the deceased, many facts, capable of throwing an important light on the case, would remain unnoticed or unknown, but for his attention to them. The position of a dead body,—the distance at which a knife or pistol is found,—the direction of the instrument,—whether situated to the right or left of the deceased,—the marks of blood or wounds about the person, or of blood on the clothes or furniture of the apartment, are facts which must assist materially in developing the real nature of a case, and in giving force to a medical opinion. Many of these circumstances can fall under the notice of him only who is first called to the deceased; and, indeed, if observed by another, no advantage could be taken of them without the assistance of a medical man.

In the case of *Davidson*, who was tried for murder before the Aberdeen Spring Court of Justiciary, April, 1855, the origin of certain wounds on the head of the deceased turned on the question of the presence or absence of nails at the head of the bed. On this occasion Lord Deas, the judge, remarked:—"A medical man when he sees a dead body should notice everything." There was reason to believe that some nails had been driven into the head of the bed subsequently to the infliction of the violence, so as to give the appearance of the wounds having resulted from accident. There was some medical evidence in support of the view of their accidental origin, but according to Dr. Ogston there was no blood on the bedstock where the nails were represented to have been: and as the woman had died from bleeding, this was not likely to have escaped being stained with blood. In his opinion, too, the nails would not have accounted for the wounds on the temple as the result of accident. The whole of the difficulty in this case appears to have arisen from want of proof that there were no nails in the bedstock when the woman was found dead. The prisoner was discharged on a verdict of "not proven."

Among the questions which present themselves on these occasions are the following:—Is the position of a wounded body *that* which a suicide could have assumed? Is the distance of a weapon from the body such as to render it improbable that it could have been placed there by the deceased?—In answering either of these questions, it is necessary to take into consideration the extent of the wound, and the period at which it probably proved fatal. Again, it may be inquired: Has the deceased bled in more places than one? Are the streams of blood all connected? Are there any marks of blood on his person or clothes, which he could not well have produced himself? Are there any projecting nails or other articles which might account for wounds on the body as the result of accident? These are questions, the answers to which may materially affect the case: hence, a practitioner in noticing and recording the circumstances involved in them, ought to exercise due caution. "The consideration of the nature of circumstantial evidence," observes Starkie, "and of the principles on which it is founded, merits the most profound attention. It is essential to the well-being at least, if not to the very existence of civil society, that it should be understood, that the secrecy with which crimes are committed will not insure impunity to the offender. At the same time it is to be emphatically remarked, that, in no case, and upon no principle, can the policy of preventing crime and protecting society warrant any inference which is not founded on the most full and certain conviction of the truth of the fact, independently of the nature of the offence and of all extrinsic considerations whatever. Circumstantial evidence is allowed to prevail to the conviction of an offender, not because it is necessary and politic that it should be resorted to, but because it is in its own nature capable of producing the highest moral degree of certainty in its application. Fortunately for the interests of society, crimes, especially those of great enormity and violence, can rarely be committed, without affording vestiges by which the offender may be traced and ascertained. The very measures which he adopts for his security, not unfrequently turn out to be the most cogent arguments of guilt. On the other hand, it is to be recollected, that this is a species of evidence which requires the utmost degree of caution and vigilance in its application: and, in acting upon it, the just and humane rule, impressed by Lord Hale, cannot be too often repeated:—tutius semper est errare in acquietando quam in puniendo, ex parte misericordiæ quam ex parte justitiæ."

(Vol. 1. p. 480.) Evidence is *direct* when a fact is proved by witnesses, and *circumstantial* when the fact is at once proved by circumstances. More commonly the evidence is *presumptive*, i. e. founded on an inference from circumstances.

The common rule respecting the admissibility of this kind of evidence applies to circumstances of a *medical* as well as those which are of a physical or moral kind. Medical circumstances, when properly observed, are often of the highest importance. In order to convict an accused person on circumstantial evidence, the facts proved in the case should square with the hypothesis of his guilt, and be utterly inconsistent with his innocence; or, in the language of another learned judge, a certain number of material facts should be incontestably proved in the case, which are quite inconsistent with the innocence of the prisoner. These facts should be such as to render it impossible in the minds of the jury, that any one but the prisoner could have committed the murder. The late Baron Alderson, in charging a jury to this effect, made an observation which should be remembered by medical witnesses, in reference to circumstantial evidence. He pointed out to them "the proneness of the human mind to distort the facts in order to establish such a proposition (the guilt of the prisoner), forgetting that *a single circumstance* which is inconsistent with such a conclusion, is of more importance than all the rest, inasmuch as it destroys the hypothesis of guilt."

There are many cases on record in which an observance of slight and unexpected circumstances by medical men has led to the detection of offenders. In the Life of Sir Astley Cooper, it is mentioned, that when called to see *Mr. Blight*, of Deptford, who had been mortally wounded by a pistol-shot in the year 1806, he inferred from an examination of the localities, that the shot must have been fired by a *left-handed* man. The only left-handed man near the premises at the time was a Mr. Patch, a particular friend of the deceased's, who was not in the least suspected. This man was, however, subsequently tried and convicted of the crime:—and he made a full confession of his guilt before execution.

The rules for investigating a case of poisoning (see p. 32) may be equally observed in many cases of death from violence. Among the circumstances to which a medical witness should specially direct his attention on these occasions are the following:—

1. *The position of the body.*—The body may be found in a position which the deceased could not have assumed on the supposition of the wound or injury having been accidental or suicidal. The position of a dead wounded body is often only compatible with homicidal interference, either at the time of death, or immediately afterwards. In order to determine the

probable time of death, we should always notice whether there is any warmth about the body,—whether it is rigid, or in a state of decomposition, and to what degree this may have advanced. In the case of a female who was found dead in her apartment with her throat cut, in November 1847, it was ascertained that when first discovered, the body was so warm as to render it highly probable that the crime must have been committed within an hour. This observation tended to prove the innocence of a party who was suspected of the murder, because it was known that he had been absent from the house for at least five hours.

Criminals sometimes unknowingly furnish important evidence in reference to the condition of the body. In *Reg.* v. *Hopley* (Lewes Autumn Assizes, 1860), the prisoner was convicted of flogging a pupil to death. There was reason to believe that the boy died during the actual beating. The accused stated before the coroner that he went into deceased's bedroom about six o'clock in the morning, and found deceased dead, his body cold, and his arms stiffening. He suggested that he might have died from natural causes. It was proved that the prisoner was heard in the act of beating deceased up to 11.30 on the previous night, and as the body was cold when found, and rigidity was commencing, there was a strong probability that deceased must have been dead at least six or seven hours, and, therefore, at the time when the prisoner was last known to be with him. The body was well developed, covered with bed-clothes, and the temperature not at the time low.

2. *The position of the weapon.*—If a person has died from an accidental or self-inflicted wound, likely to cause death either immediately or within a few minutes, the weapon is commonly found either near to the body or within a short distance of it. If found near, it is proper to notice on which side of the body it is lying; if at a short distance, we must consider whether it might have fallen to the spot, or have been thrown or placed there by the deceased. If there has been any interference with the body, all evidence from the relative position of it and the weapon will be inadmissible. In a case which was referred to me some years since, a woman had evidently died from a severe incision on the throat, which was homicidally inflicted; the weapon, a razor, was found under the left shoulder, a most unusual situation, but which, it appears, it had taken owing to the body having been turned over before it was seen by the surgeon who was first called. We must remember that it is quite compatible with suicide that a weapon may be found at some distance, or in a concealed situation; but it is much more frequently either grasped in the hand, or lying by the side of the deceased.

In one instance, it is stated the deceased was discovered in bed with his throat cut, and the razor lying *closed* or shut by his side. In another case, the bloody razor closed, was found in the deceased's pocket. In the case of a *Captain Wright*, who was found dead in one of the French prisons (during the war with France), it is stated on good authority that the *razor shut*, was held in the hand of the deceased. In a wound involving the great blood-vessels of the neck, it is most improbable that there should be any power to close or shut the razor with which the wound was inflicted; and there are fair grounds to suspect interference when a razor is thus found closed. There is, however, one circumstance in relation to a weapon strongly confirmatory of *suicide*. If the instrument is found firmly grasped in the hand of the deceased, no better circumstantial evidence of suicide can, perhaps, be offered. It is so common to find knives, razors, and pistols grasped in the hands of suicides, that it is quite unnecessary to produce cases illustrative of this statement. The grasping of a weapon appears to be owing to muscular spasm persisting after death, and manifesting itself under the form of what has been called cadaveric spasm—a condition quite distinct from rigidity, although often running into it. It does not seem possible that any murderer could imitate this state, since the relaxed hand of a dead person cannot be made to grasp or retain a weapon, like the hand which has firmly held it by powerful muscular contraction at the last moment of life. Of this the case of *Reg.* v. *Saville* (Nottingham Summer Assizes, 1844), furnishes an illustration. A woman was found dead with her throat cut, and there was a razor *loose* in her hand. There was *no blood upon the hand* which held the razor, and this, together with the fact of its being quite loose, rendered it certain that it must have been placed there by the prisoner after having cut his wife's throat. A case, in which the facts were somewhat similar, was tried at the Liverpool Winter Assizes, 1855 (*Reg.* v. *Heywood*). The deceased in this case, a female, was found dead in bed with her throat cut. The medical evidence showed that the wound was six inches from right to left,—extending across the throat to a point under the left ear, the upper portion of the windpipe was severed, and the jugular vein, as well as the muscular branches of the carotid artery, were divided. The medical witnesses considered that the wound in the throat had not been inflicted by herself. It was such a wound as a *left*-handed person would have inflicted, and the hand inflicting it, as well as the weapon, could not have escaped being marked with blood. It appears, that when the body was found there was a razor in the *right* hand, not tightly held. The arms were folded across the chest, the right hand resting on the left, the back of the razor being towards the person of deceased. There was *no blood* on the *hands*, arms, or chest, and only one small spot on the razor. There was blood on the under side of a pillow, and a corresponding stain on the bolster, showing that this must have been turned over, and the head placed on the clean side after the infliction of the wound. All the circumstances concurred in showing that an attempt had been made to simulate an act of suicide, while the facts were only consistent with homicide. The prisoner was connected with the act by the moral as well as circumstantial evidence, and he was convicted and executed.

The deceased may be found with some article grasped in the hand. (See case, Ann. d'Hyg. 1829, t. 1. p. 464.) It may be her own or the prisoner's *hair* torn off in the struggle for life; and on this point a question of identity may be easily raised. (*Reg.* v. *Ellison*, Bodmin Summer Assizes, 1845.) In a case which occurred to Dr. Marc, a woman was found assassinated in her house, and when the body was discovered, a small snuff-box was still held firmly in one hand. This proved that the murder must have taken place very suddenly, and without any resistance on the part of the deceased. (Ann. d'Hyg. 1829, t. 1. p. 465.)

If the weapon cannot be discovered, or if it be found concealed in a distant place, this is strongly presumptive of homicide, provided the wound be of such a nature as to prove speedily fatal. In the case of *Lord William Russell* (1840) no weapon could be discovered: and although the wound in the throat bore some of the characters of a suicidal incision, the absence of the weapon was sufficient to show that it must have been the act of a murderer. With respect to the weapon being found at a distance from the body, other circumstances should be taken into consideration before any opinion is expressed. We may observe whether the weapon, if it be a sharp cutting instrument like a razor, has been recently notched; for this might show that a degree of force or violence has been used, not easily reconcilable with the suicidal use of the instrument. The well-known case of the *Earl of Essex*, who was found dead in the Tower, in July 1683, gave rise to a doubt on this point. The deceased was discovered with his throat cut, and a razor without a handle lying near him. This razor was found to be much notched on the edge, while the throat was smoothly and evenly cut from one side to the other, and to the vertebral column. Some considered this to have been an act of suicide, others of murder. Those medical witnesses who supported the view of suicide, were asked to explain how it was that such an even wound could have been produced by a notched razor. They attempted to account for this by asserting that the deceased had probably notched the razor by drawing it backwards and forwards across the neck-bone; forgetting that before this could have been done by the deceased, all the great vessels of the neck must have been completely divided!

3. *Blood on weapons.* — It does not always happen that the weapon with which a wound has been inflicted is covered with blood. It has been remarked, that in the case of stabs, the knife is frequently without any stains of blood upon it; or there is only a slight film, which, on drying, gives to the surface a yellowish-brown colour. The explanation of this appears to be that in a rapid plunge the vessels are compressed, so that a bleeding takes place only after the sudden withdrawal, when the pressure is removed. Even if blood should be effused, the weapon, in being withdrawn, is sometimes cleanly wiped against the edges of the wound, owing to the elasticity of the skin. Thus, the first stab through the dress may not present any appearance of blood on the outside, but in a second stab, with the same weapon, the outside of the dress should present a bloody mark, unless the weapon had previously been wiped. The blood may have been removed by washing from the blade of a knife or dagger. The handle and inner portions should therefore be closely examined. In a case of alleged murder (Nov. 1857), I found no blood on the blade of a knife or in the notch for opening it: but on removing the buck-horn handle, I found a coagulum of blood between this and the plate of iron to which it was riveted.

When a weapon is bloody, particular attention should be given to the manner in which the blood is diffused over it. In cases of imputed wounds, or in the attempted concealment of murder, it is not unusual for a criminal to besmear with blood a knife or other weapon which has probably not been used. A case of this kind occurred to the late Dr. Marc. A young man alleged that he had received a cut on the forehead by a blow from a cutlass, which he produced. It was remarked, that the weapon was smeared with blood on both surfaces: but the layers were thicker towards the handle than at the point. The wound on the forehead was a clean incision; a cap, which the complainant wore had been cut through. It was obvious, therefore, that the blood on the weapon could not have proceeded from this cut: for it would have been wiped, or only left in thin streaks, and more towards the point than the handle, by the act of drawing it through the clothes in producing the wound. There was no doubt that blood had been intentionally applied to the blade. (Ann. d'Hyg. 1829, vol. 1. p. 263.)

The blood on a weapon may be in a partly coagulated state, and not diffused as a mere film. This would render it probable that it had issued from the body of a living person or animal, or from a body recently dead. The blood of a *dead* animal dried in small spots on the blade of a knife may sometimes present a similar appearance, and thus lead to a mistake in evidence. This question arose in the case of *Reg.* v. *Nation* (Taunton Spring Assizes, 1857). Deceased was found dead in a cart with his throat cut, and there could be no doubt that this was an act of murder. The prisoner, who had been last seen in his company, was arrested, and a knife was found in his possession, on the blade of which there were marks of blood. On the part of the prosecution, it was contended that the knife had been used for cutting the throat of the deceased, while, according to evidence given for the defence, it had been used for cutting raw meat (beef). Mr. Herapath, who was called for the prosecution, stated that the knife had been immersed in *living* blood up to the hilt,—that it was *not* the blood of an ox or a sheep, and that there were on the blade of the knife certain scales or empty cells, such as are found in the mucous membrane of the throat (epithelial scales?). They were much larger than the globules of the blood, and were perfectly distinguishable by the microscope. From the appearance he thought the knife had passed through the mucous membrane which forms the lining of the throat! If this evidence were trustworthy there was an end to the defence; and with the admission of the statement that there were scales of the mucous membrane of the *throat* (the gullet?) upon the blade, no further proof was required that the weapon had been used for cutting a throat. Fortunately for the ends of justice, there were other circumstances which brought the crime home to the prisoner, and he was convicted. (Med. Times and Gaz. April 11th, 1857.) Chief Justice Cockburn, in commenting on these microscopic subtleties, said, "Mr. Herapath took upon himself to say it was not the blood of a *dead* animal. It was *living* blood, and *human* blood; and he had shown them the marvellous powers of the modern microscope. At the same time, admitting the advantages of science, they were coming to great niceties indeed, when they speculated upon things almost beyond perception, and he would advise them not to convict upon this scientific speculation alone."

4. *Hair and other substances on weapons.*—In some instances no blood may exist on a weapon, but a few hairs or fibres may be found adhering to it if the weapon be of a bruising kind. The main question will be, in such a case, whether the hair is that of a human being or of an animal. The importance of examining closely the hair found on weapons is shown by a case quoted by Dr. Lyons, in which a hatchet having clotted blood and hair adherent to it was produced as evidence against an accused person, under whose bed this weapon had been found. This, with other circumstantial evidence, had turned public opinion strongly against the prisoner, when a physician who happened to be in court, examined the hair with a pocket lens, and pronounced that it was not human, but belonged to some animal. This circumstance led to a more complete sifting of the evidence, and the accused was acquitted. It turned out that he had killed an animal with the hatchet, and had care-

lessly thrown the weapon under the bed. (Apology for the Microscope, p. 24.) In *Reg.* v. *Hansen* (Bodmin Lent Assizes, 1856) the weapon by which the deceased lost his life was a heavy stone found near the dead body. The base of the skull was fractured, and there were upon the stone, marks of blood with some hair similar to that of the deceased. The prisoner was connected with the act by his having been seen with the stone, or one closely resembling it, in his possession. On these and other circumstances he was convicted.

Before any coagulated blood is removed from a weapon it should be examined carefully by the microscope. Hairs or fibres of linen or cotton, or other substances, may be found imbedded in the solidified blood either on the edge or on the blade; and evidence of this kind may occasionally be of great importance. In *Reg.* v. *Harrington*, (Essex Lent Assizes, 1852), a razor was produced in evidence, with which it was alleged the throat of the deceased had been cut. I examined the edge microscopically, and separated some small fibres from a coagulum of blood, which, under a high magnifying power, turned out to be cotton fibres. It was proved at the trial that the assassin in cutting the throat of the deceased, while lying asleep, had cut through one of the strings of her cotton nightcap. This was a strong circumstance to show that the razor produced was the weapon with which the fatal wound had been inflicted.

5. *Foreign substances in wounds.*—In gunshot wounds, the examination of wadding or paper found in a wound or near a dead body has in more than one instance led to the detection of the person who had committed the crime. His hand-writing has been traced on the paper used as wadding, or it has been found to have been part of a printed page, of which the remainder has been discovered in his possession. When a gun is discharged near to the body, a portion of the wadding is generally carried into the large irregular wound which is produced. This was part of the evidence in the case of *Reg.* v. *Blagg* (Chester Summer Assizes, 1857). The peculiar character of the wadding found in the body connected the prisoner with the act.

Foreign substances are sometimes discovered in contused or lacerated wounds: and these may throw an important light on the circumstances under which the crime was perpetrated. In *Reg.* v. *Hazell* (Taunton Lent Assizes, 1848), the body of the deceased was found in a well. When examined, there were on the head several severe wounds quite sufficient to account for death. There was much blood on the clothes and face, and in the blood were sticking a quantity of hay-seeds, which led the medical witnesses to consider that the wound must have been inflicted in a stable or in some place where there was hay. On examining a neighbouring stable, the spot where the murder was committed was rendered evident by the discovery of marks of blood.

There may be found in the wound a portion of the weapon. The preservation of this is important, as it may serve to connect the prisoner with the act, should his criminality be otherwise doubtful. In *Reg.* v. *De Salvi* (C. C. C. October, 1857), it was proved that the deceased died from a stab inflicted on him by the prisoner. Two inches of the pointed portion of the blade of a knife were found imbedded in one of the vertebræ. The spinal cord had been divided, and paralysis ending fatally, was a result of the wound. The identity of the weapon was not only established, but the force with which it had been used by the prisoner was clearly indicated.

6. *Marks of blood on clothing or furniture.*—It is proper to notice all marks of blood on the clothes of the deceased or in the apartment, and observe where the greatest quantity of blood has been effused: this is generally found in the spot where the deceased has died. The deceased may have bled in more places than one: if so, it is proper to notice whether there is any communication in blood between these different places. Blood on distant clothes or furniture will show whether the deceased has moved about, and whether he has struggled much after receiving the wound. Acts of locomotion by a wounded person who has died from loss of blood, or by a criminal whose hands and feet may be bloody, are generally indicated by tracks or marks of blood. The observation of these marks is of medical importance at the time that a dead body is found. They may be so situated as to show that the body has been moved or been interfered with after death, and thus throw a light upon the question whether the act has been one of homicide or suicide. In *Reg.* v. *Hatto* (Bucks Lent Ass., 1854), a mark of blood, as from the smear of a hand, was traced along a passage of the house in which the body of the deceased was found. The mark was continued over the door-post into a back room, which was found locked and bolted on the inside. The crime was thus fixed upon the prisoner; for no one breaking into the house in front could have had access to this room. The evidence thus brought against him was derived from his feeling his way with a bloody hand in the darkness after the murder. He was not at the time aware that he was thus leaving impressions which would show that no one but himself could have perpetrated the crime. It is a fair subject of medico-legal inquiry on these occasions, whether there are any marks of blood about the apartment, which no one but the assassin could have produced.

It is advisable, if it be possible, to have some clear proof that the clothes sent for examination were actually worn by the accused, or belonged to the deceased. Serious mistakes are sometimes made, and opinions should therefore be expressed with caution. In the case of *Hatto* (Bucks Lent Assizes, 1854), the clothes said to have been worn by the prisoner on the night of the murder were sent to me for examination. On the shirt there were no marks of blood: on the trousers and cap there were a few stains of blood; but it was admitted that, from the appearance of these, they might have been on the clothes five or six weeks, and therefore several weeks prior to the date of the murder. Owing to this want of certainty respecting date, the clothes were not produced in evidence; and it subsequently turned out by the confession of the prisoner, and the discovery of other articles of dress in places where he admitted he had concealed them, that those which had been examined were *not* the clothes worn by him when he perpetrated the murder! In the case of *Munro* (Cumberland Spring Assizes, 1855), the clothes supposed to have been worn by the prisoner were also sent to me for examination. There was no blood on the trousers, and it appeared from the evidence given at the trial that the prisoner had changed this article of dress.

We must observe likewise, whether, if the wound be in the throat or chest, blood has flowed down in front of the clothes or person, or whether it has flowed so as to collect in the armpits; for these appearances will sometimes show whether the wound was inflicted when the person was standing, sitting, or lying down. If the throat is cut while a person is lying down, it is obvious that the blood will be found chiefly on either side of the neck, and not extending down the front of the body. Few suicides cut the throat while in a recumbent posture, and the course which the blood has taken may, therefore, be sometimes rendered subservient to the distinction of a homicidal from a suicidal wound. The position in which the body was, when the wound was inflicted, is a frequent question on inquests and criminal trials. In the case of *Lord William Russell* (*Reg.* v. *Courvoisier*, C. C. C. 1840), the throat had evidently been cut while the deceased was lying in bed: the blood was effused on each side of the neck only. There was also found a wound on the thumb of the right hand of the deceased, which was probably inflicted at the time the hand was put up to defend the throat. Recent wounds on the back of one or both hands, when found in persons who have died from wounds in the throat, are, cæteris paribus, strongly presumptive of homicide. There may, however, be no marks of wounds on the back of the hands, if the person was attacked unexpectedly—if he was intoxicated, or rendered powerless, or if several had combined to attack him, while he was pinioned and held by an accomplice.

If the deceased had been wounded with his clothes on, we should notice whether any part of his dress has or has not been cut or injured over the situation of the wound:—whether the cut portions of dress are bloody, and whether the blood has been effused or applied on the *inside or outside*. When, together with a wound in the throat, we find the cravat and the shirt, or part of the dress, cut through, this is, all other circumstances being equal, strongly presumptive of homicide; for it is not usual that a suicide, unless labouring under confirmed insanity, would allow any mechanical obstacles of this kind to remain as an obstruction to the use of a weapon. In a case of homicidal wound of the throat, inflicted in the recumbent posture, the cravat of the deceased had been lifted up, and afterwards allowed to drop over the wound in order to conceal it. The importance of examining the dress, and comparing it with the marks of violence on the body, has already been pointed out. (See case by Mr. Codd, *ante*, p. 248.)

The nature of the dried spots of *mud* on clothing may occasionally serve to connect an accused person with an act of murder. In the case of the *Queen* v. *Snipe and others* (York Winter Assizes, 1852), evidence was adduced to show that some spots of mud on the boots and clothes of the prisoner, when examined microscopically, presented infusorial shells, and some rare aquatic vegetables, particles of soap, confervæ, and hairs from the seeds of groundsel. The mud of a ditch close to which the body of the deceased was found, presented the same microscopic appearances as the mud on the prisoner's boots: and the witness who gave this scientific evidence, deposed that in his opinion the mud-spots were derived from this ditch. He had examined the mud of all the other ditches in the locality, and found it to be different. Admitting the opinion to have been correct, this circumstance clearly connected the prisoner with the act; and it was borne out by the fact that he had been seen near the spot on the night of the murder. In a recent case (Nov. 1857) I found granules of wheat-starch mixed with the blood-stains on the gaiters of a man charged with murder. He had been just before the occurrence engaged in sowing seed-corn.

7. *Marks of blood on the person.*—All marks or stains of blood on a dead body require special observation. The impression of a hand, or of some of the fingers, may be found on the skin in a situation where it would have been improbable or impossible for the deceased to have produced it, even supposing that one or both of his hands were covered with blood. In one case of murder, there was found the bloody impression of a left hand upon the back of the *left hand* of the deceased, in such a position, that it was quite impossible the deceased himself could have made the mark! In all cases we should notice whether the *inside* or *outside* of the hand, or whether one or both hands, are marked with blood, and to describe the size and position of the marks. Stains of blood on the dress of a wounded person may often furnish important circumstantial evidence. If there are several stabs or cuts on the body involving the dress, it should be observed whether the edge of one or more of them is

stained with blood, as if from the wiping of a weapon, and whether the stain is on the outside or inside of the article of dress (*ante*, p. 268). In simulated personal injuries, the stain of blood may be, through inadvertence, applied to the outside of the dress—a fact which might, in some instances, lead to the detection of the imposture. (See case by Dr. Bayard, Ann. d'Hyg. 1847, vol. 2. p. 219.) In judging from marks of blood in the *apartment*, we must take care that we are not unconsciously misled by the accidental diffusion of this liquid by persons going in and out. The following case, which occurred in France, will show the necessity of extreme caution. A young man was found dead in his bedchamber with three wounds on the front of his neck. The physician who was first called to see the deceased had, unknowingly, stamped in the blood with which the floor was covered, and had then walked into an adjoining room, passing and repassing several times; he had thus left a number of bloody foot-prints on the floor. No notice was taken of this at the time; but on the following day, when the examination was resumed, the circumstance of the foot-prints was particularly attended to, and excited a suspicion that the young man had been murdered. The suspected person was arrested, and would have undergone a trial on the charge of murder, had not M. Marc been called in to examine all the particulars of the case. A similar circumstance occurred in the case of *Eliza Grimwood*, who was murdered at Lambeth in June, 1838.

8. *Arterial distinguished from venous blood.*—It is not possible to distinguish *arterial* from *venous* blood by any physical or chemical characters, when it has been for some days effused, and has fallen upon articles of dress or furniture: but this, in medico-legal practice, is not often a subject of much importance, since there are few cases of severe wounds, either in the throat or other parts of the body, in which the two kinds of blood do not escape simultaneously. The most striking and apparent difference between them, when recently effused, is the *colour*, the arterial being of a bright red, while the venous is of a dark red hue; but it is well known that the latter, when exposed to air for a short time, acquires a florid red or arterial colour: and the two kinds of blood, when *dried*, cannot be distinguished by any known criterion. If the coat or other stuff, covered with blood, were of a dark colour, the liquid would be absorbed, and lose its physical characters. Arterial blood contains more fibrin than venous, and coagulates more firmly. Even the microscope shows no appreciable difference in the blood-corpuscles; and chemistry does not enable us to apply any test so as to make a satisfactory distinction between them. In this deficiency of microscopical and chemical evidence, an attempt has been made to establish a distinction by noticing the

physical appearances of the blood-stains. Thus, it is alleged, arterial blood will be indicated by its being *sprinkled* over surfaces upon which it has fallen, while venous blood is always poured out in a full stream. In most wounds which prove fatal by bleeding, the blood is poured out simultaneously from arteries and veins. The sprinkled appearance of blood, when it exists, will, cæteris paribus, create a strong presumption that it was poured out from a *living* body; for, after the heart has ceased to act, the arteries lose the power of throwing out the blood in jets. This mode of distinguishing arterial from venous blood was adduced as evidence in the case of *Sellis*, who destroyed himself after having attempted to assassinate the Duke of Cumberland. There was the appearance of sprinkled blood on the coat-sleeve of Sellis, and the temporal artery of the Duke had been wounded in the struggle. Sir Everard Home thence inferred that Sellis had attacked the Duke, and wounded the artery, which had led to the sprinkling of the sleeve. (Will's Circ. Ev. 98.) This physical method of distinguishing the two kinds of blood, therefore, may be occasionally available for practical purposes; but it must be remembered that accident may lead to the sprinkling of blood from a small vein which has been wounded, while blood may be poured out in considerable quantity from an artery, especially if large; and if it fall on one spot at a short distance, it may produce a soaked appearance. The sprinkling may be expected only when the wounded artery is small, and the blood is effused at a distance. This is a fact which a medical jurist should not overlook, although, for the reasons stated, too great a reliance must not be placed on it. The blood, if thrown out from a *living* blood-vessel, very speedily consolidates in small spots; and the fibrin, with the greater portion of the colouring matter, is found of a deep red colour at the lower part of the spot, the upper portion being of a pale red. The lower and thicker part has commonly a shining lustre, as if gummed, when the spot is recent, and when it has been effused upon a non-absorbent surface. The glazed appearance is probably given by the evaporation of the aqueous, and the rapid desiccation of the albuminous portion. When the blood falls upon porous articles of clothing, as linen or cotton, it is absorbed and produces a dull stain. In dark-coloured articles of dress, it is difficult by daylight to perceive these stains. The part appears stiffened, and there is a dull red-brown colour, which is sometimes more perceptible when seen by the reflection of the light of a candle. Stains of tobacco, or of the juices of certain vegetables, may present the appearance of those of blood. Such mistakes frequently occur. The distinction between them will, however, be rendered immediately apparent by the application of the microscope and of the chemical processes to be hereafter mentioned. (See BLOOD-STAINS.)

In trusting to the *coagulation* of the blood as evidence of its escape from a *living* vessel, it must be remembered that there are certain diseases, as scurvy and typhus, in which, owing to morbid causes, the blood does not readily coagulate after death: while, again, some hours elapse before it coagulates in the healthy body after death. Hence blood which has escaped from a recently dead body, although it would not be found diffused as if by spirting, might, in so far as coagulation is concerned, assume the appearance of having been effused from a living body. (See case of *Reg.* v. *Nation*, *ante*, page 269.) On this fact Donné has founded a process for determining whether a person is really dead. (Cours de Microscopie, p. 54).

When spots of blood are found upon articles of dress or furniture, their *form* and *direction* may occasionally serve to furnish an indication of the position of the person with respect to them when the wound was inflicted. Thus, if the form of a spot is oval and elongated, the presumption is that the person was placed obliquely with respect to the stained furniture, during the hæmorrhage. (Ann. d'Hyg. 1840, p. 397.) The force with which the blood has been thrown out, will be in some measure indicated by the degree of obliquity and length of the spot. This is in general wide and rounded at the upper part but narrow and pointed below. The case of *Spicer* (*ante*, page 260) furnishes some suggestions on the importance of evidence occasionally derived from an examination of the form and direction taken by spots of blood. At the top of the stair, and at the height of four or five feet above the level, several spots of blood were observed upon the brick wall. These were rendered evident by the wall having been recently white-washed. The spots took an oblique direction from above downwards, were of a pale red colour at the upper part, but dark red below, terminating in a point consisting of the fibrin and the greater part of the red colouring matter. Their form and regularity proved that they had proceeded from a small artery, and that the wounded individual could not have been very distant from the wall, while their shining lustre rendered it probable that they were of recent origin, and their well-defined termination in a firm coagulum, showed that they had probably proceeded from a living blood-vessel. The deceased had died from fracture of the skull and vertebral column by a fall from the top-stair: one branch of the right temporal artery was found divided, and this wound could not have been produced by the fall. It was therefore evident that a murderous assault had been made upon the deceased at the top of the stair, and this had led to the spirting of the arterial blood on the brick. The height at which the spots existed, and their appearance, proved that the jet of blood had been from above downwards; thereby rendering it probable that deceased was standing up, or that her head was raised at the time the wound was inflicted. Further, as the brick with the spots was on the left hand in the descent, and the wounded artery was on the right side, it is probable that deceased was face to face with her assailant in the act of ascending the stairs, and that she was killed by being precipitated backwards to the bottom. The position in which the body was found in the cellar corroborated this view. (See Med. Gaz. vol. 37. p. 612.)

In examining a dead body, attention should be paid to the state of the *mouth* and *throat*. Assailants who make their attack during sleep, sometimes endeavour to close the mouth, or to compress the throat, so as to prevent an alarm from being given. In the case of the *Duchess of Praslin*, there were the marks of finger nails around the mouth. In another case, ecchymosed impressions, as if produced by a hand, were found upon the throat of the deceased. The *hands* of the dead person should always be examined; many cuts, excoriations, or incisions, found upon them, especially if on the dorsal surface (back), will indicate that there has been a mortal struggle with the assailant. In the inspection, the examination of the *stomach* should not be omitted. The presence or absence of food, mucus, or blood, may furnish evidence of considerable importance in the elucidation of the case. Thus, in the stomach of the *Duchess of Praslin*, a quantity of bloody froth was discovered. This rendered it certain that she had lived sufficiently long to swallow a quantity of saliva mixed with blood, and that probably she had made some attempts to give an alarm. The fact that several days have elapsed since death, will not prevent the discovery of food in the stomach, provided it has been taken within one or two hours before death: since the digestion of food does not appear to go on to any perceptible extent after death. I have thus discovered food in the stomach twenty-eight days after interment. This question connected with the digested or undigested state of the food found in the stomach, frequently arises on criminal trials. (See *Spicer's* case, *ante*, p. 260.)

CHAPTER 26.

DISTINCTION OF SUICIDAL FROM ACCIDENTAL WOUNDS — WOUNDS ON THE THROAT — FACTS INDICATIVE OF SUICIDE, HOMICIDE, OR ACCIDENT — IMPUTED OR SELF-INFLICTED WOUNDS — MOTIVES FOR THEIR PRODUCTION — CHARACTERS OF IMPUTED WOUNDS — RULES FOR DETECTING FALSE CHARGES.

Suicidal wounds.—It is not often that any difficulty is experienced in distinguishing a *suicidal* from an *accidental* wound.

When the wound has really been suicidally inflicted, there are generally to be found about it clear indications of design; and the whole of the circumstances are seldom reconcilable with the supposition of accident. But if the position of the deceased with respect to surrounding objects has been disturbed, if the weapon has been removed, and the body transported to a distance, then it will not always be easy to distinguish a wound accidentally received, from one inflicted by a suicide or a murderer. The evidence of those who find the body can alone clear up the case; and the medical witness may be required to state how far this evidence is consistent with the situation, extent, and direction of the wound by which the deceased has fallen. It is unnecessary to dwell further on this subject, since the observations made in the preceding pages will suggest to a practitioner the course which he should pursue. Circumstantial evidence is commonly sufficient to show whether a wound has been accidentally received or not; but as an accidental wound may sometimes resemble one of homicidal or suicidal origin, so it follows that it is not always possible for a medical jurist to decide the question peremptorily from a mere inspection of the wound. Homicide is only liable to be confounded with accident in relation to *contusions* and *contused* wounds. In cuts and stabs, the evidence of design will be in general too apparent to allow of any doubt being entertained respecting the real origin of the injury. It would not be difficult to produce many instances in which murderers, in their defence, have alleged that the wounds observed in the bodies of their victims were of accidental origin, and the allegations have been clearly refuted by medical evidence. A witness must be prepared, therefore, in all cases in which death has taken place in secrecy, and the nature of the wound is such as to render its origin doubtful, to be closely examined by counsel for a prisoner charged with felonious homicide, on the question whether the wound might or might not have been accidental. Our law requires that it should be rendered evident to a jury, before such a charge can be sustained, that the fatal wound could *not* have been accidental or suicidal. Hence this preliminary question is deserving of the attention of a medical jurist.

The death of a person from wounds has hitherto been considered as a subject connected with a criminal charge: but an investigation of the circumstances under which death ensues, is occasionally rendered necessary when the deceased has effected an insurance upon his life. A policy of life-insurance is in some cases rendered void by the act of self-destruction: and therefore an individual bent on suicide might, for the sake of his family, take precautions to conceal the manner in which he intended to destroy himself. His body might be found wounded in a manner which would render it uncertain whether he had been wounded accidentally, whether he had been murdered, or whether he had fallen by his own hand. In a disputed case, it is incumbent on the Office to prove the act of suicide (*felo de se*), while the relatives of the deceased would attempt to show the contrary. Such litigation must, of course, call forth a searching investigation into all the circumstances connected with the death of an insured party, and the whole case would, in some instances at least, rest almost exclusively on medical evidence. (Med. Gaz. vol. 36. p. 826.)

The late Mr. Dodd, of Chichester, consulted me on the following case:—He was called to examine the body of a woman, who was found dead with her throat cut. The deceased, when seen by him, was lying on her back, and the razor with which the wound was inflicted, was found under the left shoulder. On inquiry, it was ascertained that, when first seen, she was lying on her face, and the body had been turned round on the back. Blood had evidently run down the fore-part of her person, rendering it probable that she had been wounded while in the erect position. The incision in the throat was deep, and extended obliquely from the right side of the chin, to within about an inch of the left collar-bone. It had divided the windpipe, the gullet, all the muscles of that side of the fore-part of the neck,—the carotid artery, jugular vein, and the muscles on the fore-part of the spine, penetrating even into the bodies of the cervical vertebræ. The incision was double,—one superficial, close under the chin, and the other, the deeper one, appeared to be continued from this. The deepest part of the right end of the incision was nearly three inches in a direct line behind the right angle of the wound, so that it extended at that part behind and beneath the sound skin. The cut was four and a half inches long, and two and a half deep. The main question was, whether this could have been a suicidal wound, inflicted by a razor, the only weapon found near the body. Considering its characters, Mr. Dodd inferred that it must have been inflicted by another person, and not by the deceased upon herself. The deceased was right-handed, which would have added to the difficulty of supposing the wound to have been suicidal. The inference drawn was precisely that which the medical circumstances appeared to me to justify.

Imputed or self-inflicted wounds.—The question whether a wound was or was not self-inflicted, may refer to the *living* as well as to the dead. Thus a man may produce wounds upon himself for the purpose of simulating a homicidal assault, which, for various motives, he may allege to have been committed upon him. With the motives for the self-infliction of wounds, a medical jurist is not concerned,—it is of the fact only that he can take cognizance. From the cases that have yet occurred, it would appear that the object has been to extort money, to conceal murder, robbery, or some other crime, and to turn away suspicion from the wounded party. One of the most remarkable cases of this kind which have occurred in England, was that of *Bolam*, who was tried for the murder of a man named Millie, at the Newcastle Autumn Assizes, 1839. It is impossible to enter into all the particulars of this singular trial; but it may suffice to state that the prisoner Bolam was found lying in an apartment which had been fired by himself or, as he alleged, by some incendiary, and near him was the body of the deceased, who had evidently been killed by violence,—the skull having been extensively fractured by a poker lying near. The prisoner, when found, was either insensible or pretended to be so. He stated that he had been suddenly attacked by a man, and knocked down by a blow on the right temple. After attempting to escape, he was again knocked down. He then felt a knife at his throat, but admitted that he did not put up his hands to protect it. His hands were not cut. He said he remembered receiving some blows on his body, but he became insensible, and recollected nothing more. On examining his throat, there was a wound an inch and a half in length on the left side of the neck, a quarter of an inch below the jaw. It had penetrated merely through the true skin, and was of inconsiderable extent. A small quantity of blood, which had flowed down on the inside of his cravat, had escaped from this wound. There were many cuts on his coat at the back and sides, through his waistcoat, shirt, and flannel shirt; but there were no corresponding cuts or stabs, nor, indeed, any mark of injury upon the skin. The question was, whether these wounds had been inflicted by the unknown person who was alleged to have fired the premises and murdered the deceased, or whether the prisoner had inflicted them on himself, in order to divert attention and conceal the crime which he was accused of having committed. No motive for the imputed crime was discovered, and he had borne a very good character; but, nevertheless, the medical facts relative to the probable self-infliction of the wounds were so strong, that he was convicted of manslaughter. There was no doubt that the prisoner produced the wounds upon himself in order to remove from himself the suspicion that he had caused the death of the deceased. They were superficial, involved no important organs, and bore the characters which those wounds only would have, that had not been produced with a suicidal intention.

Soon after Bolam's case, one somewhat similar occurred in London. The steward of a club-house was found one morning in bed wounded, and the cash-box of the club was missing. Circumstances led the police to suspect that no one could have broken into the house; but the man himself was considered so trustworthy, that no suspicion was entertained of his having been concerned in the robbery. The surgeon who examined him found the wounds on his person of a trivial character; and there was no doubt, from what subsequently transpired, that he had produced them on himself for the purpose of averting suspicion.

It is not always easy to trace the motive for the production of these injuries; and when a reasonable motive is not immediately discovered, persons are apt to be misled and to credit the story. Individuals who have been convicted of thus imputing violence to others have frequently borne a respectable character until the occurrence, and this has contributed to disarm suspicion. When a person intending to commit suicide fails in the attempt, he has sometimes, under a sense of shame, attributed the infliction of a wound in his throat to another; but facts of this kind may without difficulty be cleared up by circumstantial evidence. Imputed wounds, if we except the case of an actual attempt at suicide, in which the injury is commonly severe, are generally of a *superficial* character, consisting of cuts or incisions not extending below the true skin:—deep stabs are seldom resorted to where the purpose is not suicide, but merely to conceal other crimes. Further, these wounds are in *front* of the person, and may be on the right or left side, according to whether the person is right or left-handed. They have also been generally *numerous*, and widely scattered: sometimes they have had a complete parallelism, unlike those which must have been inflicted by an adversary during a mortal conflict with a weapon. The *hands* are seldom wounded, although in the resistance to real homicidal attempts these parts commonly suffer most severely. The injuries are not usually situated over those parts of the body in which wounds are by common repute considered *mortal*, and there is in general an entire want of correspondence between the situation of the wounds on the person, and the cuts or other marks on the *dress*. This is a fact which requires the attention of a practitioner. In a case which occurred to Marc, a young man alleged that he had received a sword-cut on the forehead from some assailants who had escaped. He was allowed to relate the whole of the particulars, and they formed a romantic and improbable story. He stated that he wore at the time a handkerchief round his head, a cotton cap, and a common cap with an elastic front, which he alleged had been cut through. There was a longitudinal wound, quite superficial and about an inch long, at the upper and right part of the frontal bone, passing downwards from *left to right*. The cut in the felt of the cap, which was very soft, passed obliquely from *right to left*, and was about three inches in length. The cut was not so clean or regular as if it had been produced by a sword: there was very little blood upon the cap, and only on the edge of the incision. The silk handkerchief was cut in an irregular manner. When the party was requested to place the cap and other articles upon his head in the position in which he stated they were when he was attacked, it was found to be utterly impossible to adjust them,—the incisions could not be made to correspond, and the cap could not be worn over the folded handkerchief. This rendered it certain that the wound had not been inflicted in the manner described. Besides a blow of a sword which would have divided the felt and silk handkerchief, would at the same time have produced a much deeper wound on the forehead than that which was found. In a case reported by Dr. Bayard, the falsehood of a charge was demonstrated by the want of correspondence between the cuts in the clothes and those found on the person. (Ann. d'Hyg. 1847, vol. 2. p. 222.)

In comparing cuts on the *dress* with wounds on the person, there are several circumstances to be attended to. What articles of dress were worn at the time of the assault? In a case of stabbing all ought to present marks of perforation, corresponding in direction, form, size, sharpness of the edges of the weapon, &c. In imputed wounds, the marks on several layers of dress may not correspond with each other in the characters above mentioned. It is very difficult for a man simulating such injuries so to arrange his clothes when off his person, as to deceive a careful examiner. There will be some inconsistency or want of adjustment. Apart from the fact that several stabs or cuts cannot exist on the same part of the clothes, without one or more being stained with blood on the outside or inside, an impostor may do too much or too little, and thus lead to his detection. In a case which excited much public discussion, a simple circumstance led to the inference that certain stabs or cuts through a shirt had not been produced while the shirt was on, but while it was off the body. There were two cuts near to each other, precisely similar in size, form, and direction. In fact, the knife or dagger producing them must have gone through a fold of the shirt, so accurate was the correspondence. Then, however, it followed that the shirt could not have been upon the body of the alleged wounded person, because a stab through a shirt when worn, must, in order to reach the body, traverse not only a fold (producing two cuts), but another layer in contact with the skin, and thus produce *three cuts*, or in the event of traversing two folds, *five cuts*. In simulating the wounds by cuts on the shirt, the person is supposed to have forgotten this, and have merely stabbed a fold of the shirt while lying on a table, or in some situation convenient for the purpose. This, among other facts, rendered it probable that the slight wounds on the chest were self-inflicted.

It has been contended that no rules can be laid down for the detection of such cases: each must be decided by the facts which accompany it. Nevertheless, the details of those above mentioned will serve to direct the inquiries of a practitioner.

The facts which he must endeavour to ascertain are the following:—1. The relative positions of the assailant and the assailed person at the time of the alleged attack. 2. The situation, direction, and depth of the wound or wounds. 3. The situation or direction of marks of blood or wounds on the person or dress of either, or of both, the assailant and assailed. 4. The marks of blood, and the quantity effused at the spot where the mortal struggle is alleged to have taken place. The importance of these inquiries cannot be over estimated. A strong suspicion was raised against the late Duke of Cumberland, in the year 1810, in reference to the death of *Sellis*, when a proper examination of the wounds would probably have shown that they could not have been self-inflicted.

It is worthy of remark, that imputed wounds are generally *cuts* or *stabs*. They are seldom of the contused kind; the impostor cannot, in reference to contusions, so easily calculate upon the amount of mischief which is likely to ensue. Pistol-shot wounds are sometimes voluntarily inflicted for the purpose of imputing murder or extorting charity. A man intending to commit suicide by fire-arms, and failing in the attempt, may, from shame and a desire to conceal his act, attribute the wound to the hand of some assassin. In examining such imputed wounds they will not be found (except in cases of attempted suicide) to involve vital parts; and they will possess all the characters of near-wounds produced by gunpowder, wadding, or a bullet. (See GUN-SHOT WOUNDS.) The skin around will be extensively lacerated and bruised: there will be much ecchymosis, and the hand holding the weapon, as well as the dress and the wounded skin, may be blackened or burnt by the exploded gunpowder. A pistol-shot wound from an assassin may be produced from a distance, while an imputed wound which is produced by a person on himself, must always partake of the characters of a near-wound. If the weapon has been charged with gun-cotton, there will be no marks of blackening on the person or dress, but there may be marks of burning.

CHAPTER 27.

THE CAUSE OF DEATH IN WOUNDS—CAUTION ON ASSIGNING TOO MANY CAUSES—WOUNDS DIRECTLY OR INDIRECTLY FATAL.—DEATH FROM HÆMORRHAGE—LOSS OF BLOOD REQUIRED TO PROVE FATAL—MODIFIED BY AGE AND OTHER CIRCUMSTANCES—FATAL WOUNDS OF SMALL ARTERIES—INTERNAL HÆMORRHAGE—DEATH FROM MECHANICAL INJURY TO A VITAL ORGAN—DEATH FROM SHOCK—BLOWS ON THE ABDOMEN—FLAGELLATION—DEATH FROM A MULTIPLICITY OF INJURIES WITHOUT ANY MORTAL WOUND—SUBTLE DISTINCTIONS RESPECTING THE MORTALITY OF WOUNDS.

Cause of death.—It is important for a medical witness to bear in mind that in all cases of wounds criminally inflicted, the cause of death must be *certain*. No man is ever convicted upon mere medical probability. In general there is only *one* real cause of death, although other circumstances may have assisted in bringing about a fatal result. Thus a person cannot die of a disease in the bowels and a stab in the chest at the same time, nor of apoplexy from disease and compression of the spinal marrow at the same instant. Hence it is our duty, when several apparent causes for death exist, to determine which was the *real* cause; and in stating it to the Court, to be prepared to offer our reasons for this opinion. In most cases of local injury, when a person dies speedily, there will be no great trouble in ascertaining whether disease or the injury was the cause. A difficulty may, however, exist when a person has recovered from the first effects of a wound, and has subsequently died. Besides, there may be cases in which the cause of death, in spite of the most careful deliberation, will be still obscure: or sometimes it may happen that the death of a party appears to be as much dependent on bodily disease as on an injury proved to have been received at the time he was labouring under disease. How is an opinion to be expressed in such a case? The course which I apprehend a medical witness ought to pursue, provided he has duly deliberated on the circumstances before he appears in Court, and his mind is equally balanced between the two causes, is to state at once his doubt to the jury without circumlocution, and not allow it to be extracted from him by an adverse cross-examination. It is the hesitating to assign a satisfactory cause, or the assigning of many causes for death, that gives such advantage to a prisoner's case, even when the general evidence is entirely against him. Occasionally many causes of death are assigned by a witness, among which some have a tendency to exculpate and others to inculpate the prisoner in a greater or less degree, and it is left to the jury to select from the number, one upon which to found a verdict! In a case of this kind an acquittal is commonly obtained.

Wounds directly or indirectly fatal.—A wound may cause death either *directly* or *indirectly*. A wound operates as a *direct cause of death* when the person dies either immediately, or very soon after its infliction; and there is no other cause, internally or externally, to account for death. In wounds which cause death *indirectly*, it is assumed that the deceased survives for a certain period, and that the wound is followed by inflammation, suppuration, gangrene, tetanus, erysipelas, or some other mortal disease, which is a direct, and not an unusual consequence of the injury. Under this head may be also arranged all those cases which prove fatal by reason of surgical operations rendered imperatively necessary for the treatment of the injury,—presuming that these operations have been performed with ordinary skill and care. We shall for the present consider only the direct causes of death in cases of wounds. They are three in number:—1. *Hæmorrhage*, or loss of blood. 2. *Great mechanical injury* done to an organ important to life. 3. *Shock*, or concussion, affecting the brain or spinal marrow, whereby the functions of one or more vital organs are arrested, sometimes with but slight injury to the part struck or wounded. From either of these causes, a wounded person may die immediately or within a few minutes.

I. *Death from hæmorrhage.*—Loss of blood operates by producing fatal syncope. A quantity of blood escaping from a vessel, although insufficient to cause death by affecting the heart and circulation, may readily destroy life by disturbing the functions of the organ or part into which it is effused. Thus a small quantity effused in or upon the substance of the brain, or at its base, may prove fatal by inducing fatal compression; and again, if, in a case of wounded throat, blood should flow into the windpipe, it may cause death by asphyxia—*i. e.* by stopping the respiratory process. In these cases it is obvious that the blood acts mechanically; and in respect to the last condition, a medical man, unless circumspection be used, may involve himself in a charge of malapraxis. If he allow the wound to remain open, the wounded person may die through hæmorrhage,—if he close it too soon, he may die through suffocation; and, in either case, the counsel for a prisoner will not fail to take advantage of a plausible objection of this kind. In wounds of the chest, involving the heart and lungs, death is frequently due not so much to the actual quantity of blood effused, as to the pressure which it produces upon these organs. A few ounces effused in the cavity of the membrane including the heart, will entirely arrest the action of this organ.

The absolute *quantity of blood* required to be lost in order to prove fatal, must, of course, vary according to numerous circumstances. The young, the aged—they who are labouring under infirmity or disease, will perish sooner from hæmorrhage than others who are healthy and vigorous. Females, cæteris paribus, are more speedily destroyed by hæmorrhage than males. Infants are liable to die from hæmorrhage resulting from slight wounds. An infant has been known to bleed to death from the bite of a single leech, or from the simple operation of lancing the gums. Even the healthy and vigorous, when their vital powers have been depressed by maltreatment or by brutal violence, will sink under the loss of a comparatively small quantity of blood. (See Watson on Homicide, p. 90.) A medical jurist must not forget that some persons have a predisposition to hæmorrhage; and this condition is often hereditary. The slightest wound or puncture,—the bite of a leech or the extraction of a tooth, will be attended with a loss of blood which cannot be arrested, and which will slowly lead to death by exhaustion. Cases have been frequently recorded in our medical journals of fatal hæmorrhage following the extraction of teeth, when there had been previously nothing to indicate the probable occurrence of death from so trivial a cause. (For striking instances of this remarkable tendency to hæmorrhage in a family, see Brit. and For. Med. Rev., vol. 17. p. 247; also Med. Gaz. May 1842.) In the thirty-ninth volume of the latter journal, p. 86, a case is reported by Mr. Druitt, in which an unusual degree of hæmorrhage followed a compound fracture of the leg. Such cases are without difficulty detected; since a surgeon may always infer from the part injured and the extent of the injury, whether the bleeding is likely to be copious or not. When a person bleeds to death from what would, under common circumstances, be a simple wound, the admission of this fact may in certain cases lessen the responsibility of an accused party.

A *sudden loss* of blood has a much more serious influence than the same quantity lost slowly. A person may fall into a fatal syncope from a quantity of blood lost in a few seconds, which he would have been able to bear without sinking had it escaped slowly. This is the reason why the wound of an artery proves so much more rapidly fatal than that of a vein. Death speedily follows the wound of a large artery like the carotid; but it takes place with equal certainty, although more slowly, from wounds of smaller arteries. In a case in which one of the intercostal arteries was wounded by a small shot, hæmorrhage caused death in thirty-eight hours. The hæmorrhage which follows the division of the smaller branches of the external carotid artery, is often sufficient to destroy life unless timely assistance be rendered. A case was tried at the Berkshire Spring Assizes, 1832, in which it was proved that the prisoner had killed his wife by stabbing her in the leg: the anterior tibial artery was divided, and she died from hæmorrhage half an hour afterwards. Wounds of arteries, even smaller than these, might in some subjects prove fatal, if no assistance were at hand. Mr. Watson mentions a case in which the internal mammary artery on the left side was divided by a stab in the chest. The woman died on the ninth day, and four pounds of blood were found effused on that side. In another case in which an intercostal artery was divided, six pounds of blood were effused. (Op. cit. 101.) In both cases, as in most wounds of the chest, the blood not only affected the system by its loss, but by its compressing the lungs and impeding respiration. Wounds of large veins, such as the jugular, may, from the quantity of blood suddenly effused, speedily destroy life. If a wound is in a vascular part, although no vessel of any importance be divided, the person may die from bleeding. It is difficult to say what quantity of blood should be lost, in order that a wound may prove fatal. The whole quantity contained in the body of an adult is calculated at about one fifth of its weight—*i. e.* about thirty pounds: of this, one-fourth is considered to be arterial, and the remaining three-fourths are venous blood. According to Mr. Watson, the loss of from five to eight pounds is sufficient to prove fatal to adults. But while this may be near the truth, many persons will die from a much smaller quantity; the *rapidity* with which the effusion takes place having a considerable influence. It has been found, by experiment, that a dog cannot bear the loss of more blood than is equivalent to one-twelfth part of the weight of its body.

Internal hæmorrhage.—Hæmorrhage may prove fatal, although the blood does not escape from the body. In incised wounds, the flow externally is commonly abundant; but in contused, punctured, and gun-shot wounds, the effusion may take place internally, and rapidly cause death. In severe contusions, or contused wounds, involving highly vascular parts, the effusion may go on to an extent to prove fatal, either in the cavities of the body or throughout the cellular membrane and parts adjacent. In death from severe flagellation, blood may be effused in large quantity beneath the skin and among the muscles. This effusion will operate as fatally as if it had flowed from an open wound. Many pounds of blood may thus be slowly or rapidly effused.

The means of ascertaining whether a person has died from bleeding by an open wound are these:—Unless the wound is situated in a vascular part, we shall find the vessel or vessels from which the blood has issued, divided,—the neighbouring vessels empty, and the body more or less pallid; although this last condition is of course liable to be met with in certain cases of disease, as also under copious venesection,—points easily determined by an examination. The blood will commonly be found more or less clotted or coagulated on those surfaces on which it has fallen. If, with these signs, there is an absence of disease likely to prove rapidly fatal, and no other probable cause of death be apparent, it may be fairly referred to loss of blood. This opinion may, however, be materially modified in reference to open wounds, by the fact of the body not being seen on the spot where the injury was actually inflicted,—by the wound having been sponged,—the blood removed by washing, and all traces of bleeding destroyed. Under these circumstances, the case must in a great measure be made out by presumptive proof: and here a medical witness may have an important duty thrown upon him, namely, that of examining articles of dress, furniture, or weapons for marks or stains of blood.

It must not be supposed that all the blood met with round a wounded dead body, was actually effused during life. As soon as the heart's action ceases, the arteries pour out no more: but the blood, so long as it remains liquid, *i. e.* from four to eight or ten hours, and the warmth of the body is retained, continues to drain from the divided veins and smaller vessels. The quantity thus lost, however, is not considerable, unless the veins implicated are large. A question relative to the degree of this bleeding after death has sometimes been put in a Court of law.

II. *Death from great mechanical injury done to a vital organ.*—We have instances of this becoming a direct cause of death in the crushing of the heart, lungs, or brain, by any heavy body passing over or falling on the cavities, as in railway accidents. The severe mechanical injury is sometimes accompanied by a considerable effusion of blood, so that the person really dies from hæmorrhage: but in other instances the quantity of blood lost is inconsiderable, and the fatal effects may be referred to shock. Sometimes a slight amount of violence may prove fatal. These are, however, to be regarded as exceptional instances. (See case by Mr. Annan, Med. Times and Gaz., Aug. 1854.)

III. *Death from shock.*—This is sometimes a direct cause of death under the infliction of external violence: and in this case life is destroyed without the injury being to all appearance sufficient to account for so speedily fatal a result. There is no medical doubt that a person may die from what is termed shock without any marks of severe injury being discovered on the body after death. We have examples of this mode of death in accidents from lightning, or from severe burns or scalds, in which the local injury is often far from sufficient to explain the rapidly fatal consequences. As instances of this form of death from violence, may be also cited those cases in which a person has been suddenly killed by a blow upon the upper part of the abdomen or on the pit of the stomach, which is supposed to operate by producing a fatal impression on the cardiac plexus. Whether this be or be not the true explanation, it is admitted by experienced surgeons, that a person may die from so simple a cause without any mark of a bruise externally, or physical injury internally to account for death. On the skin there may be some abrasion or slight discolouration; but, as it has been elsewhere stated, these are neither constant nor necessary accompaniments of a blow. (An account of the appearances observed in a case of this kind, by Mr. Wood, will be found in the Medical Gazette, vol. 44. p. 213.) Convictions for manslaughter have taken place, when death has been produced under these circumstances. (See Travers on Constitutional Irritation, p. 432; and B. Cooper's Lectures on Surgery, p. 443; Wounds of the Abdomen, *post*; also Watson on Homicide, p. 75.) Concussion of the brain, unattended by mechanical lesion, is another example of this kind of death. A man receives a severe blow on the head; he falls dead on the spot, or becomes senseless and dies in a few hours. On an inspection, there may be merely the mark of a bruise on the scalp; in the brain there may be no rupture of vessels or laceration of structure, and all the organs of the body are found healthy. In certain railway accidents persons have died under somewhat similar circumstances. There may be no physical indication of a mortal injury, and no cause apparent to account for death. This can only be referred to the shock or violent impression which the nervous system has sustained from the blow or violence—an impression which the vital powers were wholly unable to counteract or resist. A medical witness must give his evidence with caution in such cases; since it is the custom to rely in the defence upon the absence of any visible *mortal* wound or physical injury to account for death, — a principle which, if once unrestrictedly admitted as correct, would leave a large number of deaths, undoubtedly occurring from violence, wholly unexplained. A trial took place at the Liverpool Autumn Assizes, 1837, wherein several persons were charged with the manslaughter of the deceased, by kicking him behind the right ear. The medical witness deposed that there was in this spot the mark of a severe contusion, but there was no injury whatever to the brain, and the body was otherwise healthy. He very properly ascribed death to the violent shock given to the nervous system, and the Court admitted that the cause of death was satisfactorily made out. The person who inflicted the wound was convicted.

There is another form of shock, which is of some importance in medical jurisprudence. A person may have received *many injuries*, as by blows or stripes, not one of which, taken alone, could, in medical language, be termed mortal; and yet he may die directly from the effects of the violence, either on the spot, or very soon afterwards. In the absence of any large effusion of blood beneath the skin, death is commonly referred to exhaustion, but this is only another mode of expression; the exhaustion is itself dependent on a fatal influence or impression produced on the nervous system. A prizefighter, after having, during many rounds, sustained numerous blows on the body, may, either at or after the fight, sink and die exhausted. His body may present marks of bruises, or even lacerated wounds, but there may be no internal changes to account for death. In common language, there is not a single injury which can be termed *mortal;* and yet, supposing him to have had good health previously to the fight, and all marks of disease indicative of sudden death to be absent, it is impossible not to refer his death to the direct effect of the violence. It is a well-ascertained medical fact, that a number of injuries, each comparatively slight, are as capable of operating fatally, as any single wound whereby some blood-vessel or organ important to life is directly affected. Age, sex, constitution, and a previous state of health or disease, may accelerate or retard the fatal consequences.

A case of a somewhat similar kind may present itself in the military punishment of *flagellation*, which is occasionally followed by death, either as a direct consequence of shock, or from indirect causes, such as inflammation and its consequences. At the trial of *Governor Wall*, the judge directed the jury that the long continuance and severity of pain (in flagellation) may be productive of as fatal consequences as if instruments or weapons of a destructive kind were used. It is not often that scholastic flagellation is a cause of death in this country. One case, however, has recently excited public attention from the atrocity of the circumstances attending it. It was the subject of a trial for manslaughter at the Lewes Autumn Assizes, 1860 (*Reg.* v. *Hopley*). The evidence showed that the prisoner had beaten deceased, a youth of sixteen, most severely for nearly two hours with a rope and a stick. The external wounds were slight, but an inspection showed that the muscles as well as all the soft parts beneath the skin had been considerably bruised and lacerated, and that there were extensive effusions of blood in the cellular membrane of the arms and legs. There was no mortal wound in the common sense of the term, but there was no reasonable doubt that the deceased had died from the violence inflicted on him by the prisoner. His guilt was established by the fact that he had endeavoured to conceal the effects of his violence by removing the marks of blood—that he had covered the body of deceased with clothing so as to conceal the bruises,—that he had procured a coroner's inquest to be held in haste, and while concealing from the jury the fact that he had beaten the youth on the night of his death.

stated that he had found him dead, and suggested that he might have died of disease of the heart. There can be no doubt from the medical facts of this case that the deceased died either while the prisoner was inflicting the violence or soon afterwards (see p. 265). No attempt was made to dispute the cause of death. Apart from the depressing effects on the nervous system of long continued and severe pain there was in this instance, such an effusion of blood internally as would account for the production of fatal syncope.

On a trial for murder, which took place in Germany a few years since, it was proved that the deceased had been attacked with sticks, and that he had been afterwards flogged on the back with willow switches. He died in about an hour. On inspection, there was no mortal wound, nor any injury to a vital organ; there were simply the marks of lacerations and bruises on the skin, apparently not sufficient to account for death; but this was nevertheless very properly ascribed to the violence. (Henke, Zeitschrift der S. A. 1836; also Brit. and For. Med. Rev., Jan. 1837, p. 249.) The case of the *Duchess of Praslin*, who was murdered by her husband in Paris, in August 1847, furnishes an additional proof of the fatal effects produced by numerous injuries. On an inspection of the body, it was found that on the head, neck, and both of the hands, there were no fewer than *thirty* distinct wounds, some contused, and others incised and punctured. There were also the marks of many bruises, and the impressions produced by the nails of the murderer's hand over the mouth. For the most part, these injuries were slight, and not one could be said to be necessarily mortal. The most serious wound was situated on the right side of the neck; but even here the carotid artery and internal jugular vein had escaped injury. Death was referred to the loss of blood which had taken place from the numerous wounds inflicted during the struggle with the assassin. (Ann. d'Hyg. 1847, vol. 2. p. 377.) From these considerations, it is obviously absurd to expect that in every case of death from violence or maltreatment, there must be some specific and visible *mortal lesion* to account for that event. When the circumstances accompanying death are unknown, a medical opinion should certainly be expressed with caution; but if we are informed that the deceased was in ordinary health and vigour previous to the infliction of the violence, and there is no morbid cause to account for his *sudden* illness and death, there is no reason why we should hesitate in referring death to the effects of a number of injuries. Among non-professional persons, an unfounded prejudice exists that no person can die from violence unless there be some distinct *mortal* injury actually inflicted on the body. By this we are to understand a *visible* mechanical injury to some organ or blood-vessel important to life; but this is obviously an erroneous notion, since death may take place from the disturbance of the functions of an organ important to life without this being necessarily accompanied by a perceptible alteration of structure. The prevalence of this popular error often leads to a severe cross-examination of medical witnesses. Among the questions put, we sometimes find the following:—Would you have said, from the wounds or bruises *alone*, that they were likely to have occasioned death? Now, in answer to this, it may be observed, that we cannot always judge of the probability of death ensuing from the appearance of external violence alone. Because the appearances were slight, it would be wrong to infer in any case that they were *not* sufficient to cause death by shock. Then it may be inquired, Were the wounds or bruises mortal? In the vulgar sense of the word, *i. e.* by producing great loss of blood or a destruction of parts, they might not be so; but in a medical view, they may have acted mortally by producing a shock to the nervous system. Again it may be inquired, Which of the several wounds or bruises found on the body of the deceased was mortal? The answer to this question may be,—Not one individually, but *all* contributed to occasion death by syncope or exhaustion. It must be remembered, that in cases in which a person has sustained a number of injuries, the loss of a much smaller quantity of blood than in other instances, will suffice to destroy life.

It is sometimes a difficult question to decide on the relative degree of mortality of wounds, and on the share which they have had respectively in causing death. By a wound being of itself *mortal*, we are to understand that it is capable of causing death directly or indirectly, in spite of the best medical assistance. It is presumed that the body is healthy, and that no cause has intervened to bring about or even accelerate a fatal result. The circumstance of a person labouring under disease when wounded in a vital part, will not, of course, throw any doubt upon the fact of such a wound being necessarily mortal, and of its having caused death. If there should be more wounds than one, it is easy to say, from the nature of the parts involved, which was likely to have led to a fatal result. In order to determine, on medical grounds, whether a wound was or was not mortal, we may propose to ourselves this question: Would the deceased have been likely to die at the same time, and under the same circumstances, had he not received the wound? There can obviously be no general rule for determining the mortal nature of wounds. Each case must be judged by the circumstances which attend it. In some continental states, the law requires that a medical witness should draw a distinction between a wound which is *absolutely* and one which is *conditionally mortal*. An absolutely mortal wound is defined to be that in which the best medical assistance being at hand, being sent for, or actually rendered, the fatal event could not be averted. Wounds of the heart, aorta, and internal carotid arteries, are of this nature. A conditionally mortal wound is one in which, had medical assistance been at hand, been sent for, or timely rendered, the patient would, in all probability, have recovered. Wounds of the brachial, radial, and ulnar arteries may be taken as instances. The responsibility of an assailant is made to vary according to the class of injuries to which the wound may be referred by the medical witnesses; and, as it is easy to suppose, there is seldom any agreement on this subject. Our criminal law is entirely free from such subtleties. The *effect* of the wound, and the *intent* with which it was inflicted, are looked to: its anatomical relations, which must depend on pure accident, are never interpreted in the prisoner's favour. Some extenuation may, perhaps, be occasionally admitted when a wound proves mortal through an indirect cause, as inflammation or fever, and medical advice was obtainable, but not obtained until every hope of recovery had disappeared. It appears, however, from the case of the *Queen* v. *Thomas* and others (Gloucester Aut. Ass. 1841), that the mere neglect to call in medical assistance is not allowed in law to be a mitigatory circumstance in the event of death ensuing. The deceased died from the effects of a severe injury to the head inflicted by the prisoners, but had had no medical assistance. The judge said it was possible that, "if he had had medical advice, he might not have died: but whoever did a wrongful act must take the whole consequences of it. It never could make any difference whether the party injured had or had not the means or the mind to apply for medical advice." The prisoners were convicted. According to Lord Hale, if a man be wounded, and the wound, although not in itself mortal, turn to a gangrene or fever for want of proper applications, or from neglect, and the man die of gangrene or fever, this is homicide in the aggressor; for though the fever or gangrene be the immediate cause of death, yet the wound being the cause of the gangrene or fever, is held the cause of death, *causa causati*. These nice questions relative to the shades of responsibility for personal injuries, occasionally arise in cases in which persons have been wounded at sea on board of a ship in which there was no surgeon.

CHAPTER 28.

CHEMICAL EXAMINATION OF BLOOD-STAINS—ACTION OF TESTS ON ORGANIC AND INORGANIC RED COLOURING MATTERS—STAINS OF BLOOD ON LINEN AND OTHER STUFFS—DATE OF THE STAINS—INSOLUBLE STAINS RESEMBLING BLOOD—RED PAINT MISTAKEN FOR BLOOD—SOLUBLE STAINS OF FRUITS, FLOWERS, ROOTS, AND EXTRACTS — REMOVAL OF BLOOD-STAINS FROM ARTICLES OF CLOTHING—STAINS OF BLOOD ON WEAPONS—CITRATE OF IRON MISTAKEN FOR BLOOD — DISTINCTION OF STAINS FROM IRON-RUST—COLOUR FROM RED DYES—BLOOD OF MAN AND ANIMALS—EVIDENCE FROM THE ODOUR—MICROSCOPICAL EVIDENCE.

Examination of blood-stains.—It may appear at first sight an easy matter to say whether certain suspected spots or stains on articles of clothing, furniture, or weapons, are or are not due to blood; but, in practice, great difficulty is often experienced in answering the question. If the stains are large and recent, most persons may be competent to form an opinion; but the physical characters of blood are soon changed, even when the stuff is white and otherwise favourable to an examination. Again, when the stains, whether recent or of old standing, are upon dark-dyed woollen stuffs, as blue, black, or brown cloth, or when they appear in the form of small or detached spots or thin films on dark clothing or rusty weapons, no one but a competent medical man should be allowed to give an opinion.

Chemical analysis.—There is no direct chemical process by which blood can be identified, but we presumptively establish its nature by determining the presence and properties of the red colouring matter, or *hæmatosine.* The microscope may be usefully employed in these medico-legal investigations—either alone, or in those cases in which chemistry fails to aid the practitioner. The chemical properties of the red colouring matter of blood are as follows:—1. It readily combines with cold *distilled water*, forming, if recent, a rich red solution. 2. The red colour of this solution is not changed to a crimson or a green tint by a few drops of a weak solution of *ammonia*: if the ammonia is concentrated, or added in large quantity, the red liquid will acquire a brownish tint. 3. The red liquid when *boiled* is coagulated — the colour is entirely destroyed, and a muddy brown flocculent precipitate is formed,—the quantity of which will depend on the quantity of colouring matter and albumen present. 4. The coagulum produced by boiling, when collected on a filter and dried, forms a black resinous-looking mass, quite insoluble in water, but readily dissolved by boiling *caustic potash*, forming a green-coloured solution. 5. To the above tests some have united the action of strong nitric acid, which coagulates the red colouring matter, turning it of a dirty brown hue. Such are the chemical properties of blood, whether derived from the human body or from that of any warm red-blooded animal.

Objections to the tests.—It will now be proper to mention the action of the tests upon red colouring matters, extracted from the animal or vegetable kingdom. Some of these are changed to a green colour by ammonia, as the colouring matter of the *rose*,—others to a crimson, as the red colouring matters of *cochineal*, logwood, and *lac*. But these red colours are not coagulated or destroyed by boiling. In these respects, therefore, the colouring matter of blood is eminently distinguished from them. M. Raspail has objected that a mixture of *madder* and albumen possesses all the characters assigned to blood; but this objection is more theoretical than practical. These red liquids can only deceive those who trust to a *red colour* alone. It may be observed of all such artificial mixtures, that they are changed by ammonia to a crimson or a green tint (sometimes passing through a blue), and that under no circumstances is the red colour destroyed by boiling the solution in water. The albumen, if in sufficient quantity, is coagulated, but the coagulum still retains the red colouring matter locked up within it. In the case of blood, the effect of heat is to entirely destroy the colour. Those vegetable colouring principles which are not affected by ammonia (kino and catechu) are readily known by the application of heat or by special tests. The colours are not coagulated and destroyed like the red colour of blood. (See Guy's Hosp. Reports, October, 1851.)

Stains of blood on linen and other stuffs.—Supposing the stuff to be white or nearly colourless, the spot of blood, if recent, is of a red colour; but it sooner or later becomes of a reddish brown, or of a deep brown colour. The change of colour to a reddish brown I have found to take place in warm weather in less than twenty-four hours. After a period of five or six days, it is scarcely possible to determine the date of a stain even conjecturally. In a large stain of blood on linen, no change took place during a period of five years;—it had a brown colour at the end of six weeks, which it retained for the long period mentioned. Indeed, it is extremely difficult in any case, after the lapse of a week, to give an opinion as to the *actual date* of a stain. Upon coloured stuffs, or dirty clothes, it is of course impossible to trace these physical changes in stains of blood,—on red-dyed stuffs the stain of blood appears simply darker from the first, and in all cases the fibre of the stuff is more or less stiffened. Attention should be paid to the side of the stuff, if an article of dress, *e. g.* a shirt, which has first received the stain: sometimes both sides are stained. The evidence derived from an observation of this kind may be occasionally of importance.

Analysis.—In order to determine whether a stain is due to blood, we cut a slip of the stained part of the linen, and suspend it by a thread in a small test-tube containing a small quantity of distilled water. After a few minutes, or a few seconds, should the stain be recent, a red liquid will be seen falling in fine dark threads, and collecting at the bottom of the test-tube, giving a red colour to the lower stratum of water: and a dark red-brown colour, if it be of old standing. The separation may not take place in less than an hour, if the stuff is thick and coarse or not readily pervious to water. When the stain is on thin silk it is speedily separated. Several slips of the stuff may be thus successively treated, until a liquid, sufficiently deep in colour for testing, is procured. If the quantity of coloured liquid thus obtained is small, the supernatant clear water may be carefully poured off, or drawn off by a pipette: but it is better to use a small tube and a small quantity of water. The coloured liquid may then be tested by weak ammonia, and by the application of heat. If ammonia produces any effect upon the solution of blood, it is simply to brighten it,—this alkali never changes the red colour of blood to *green or crimson.* When the stain is of old standing, the solution in water is more slowly obtained, and does not present the bright red colour of blood. The action of ammonia may also be obscure, although it never gives to the liquid a green or crimson tint. The action of *heat* is in such cases certain and effectual: if the coloured solution is in such small quantity that there is no coagulum obtained by heat, it will be difficult to give a decided opinion, from the application of chemical tests, that the stain is due to blood, and in these cases it will be absolutely necessary to resort to the use of the microscope. When the quantity of blood effused is moderately large, it may be easily detected by the above process, even after the lapse of a great length of time. I have thus detected the blood of the human body, and of the bullock, on cotton, linen, and flannel, after the lapse of *three years.* If the stuff is dyed, we should proceed to examine the stains found upon it, by a similar process. The dye is commonly fixed, and is not soluble in water. Should the colour be soluble, and form an obstacle, the microscope must be resorted to. Thus, then, in testing for blood, we rely upon—1. the ready solubility of the hæmatosine (or red colouring matter) in water: 2. the negative action of ammonia; and 3. the positive effect of heat in entirely coagulating and destroying the red colouring matter.

Objections.—It may, however, be objected that red stains closely resembling blood are occasionally found on linen and other stuffs. All such stains are either entirely *insoluble* in cold water, or they are *soluble:* if insoluble, they cannot by any possibility be mistaken for blood. Should the linen or stuff which is stained with blood have been heated to a high temperature, the colouring matter may, as a result of coagulation, be rendered insoluble in water:—but this is an exceptional condition. In the case of a body found wounded and burnt, it would be proper to allow for such a change, and the chemical evidence would fail. Should the blood-stain be mixed with oil or grease, this will interfere with the solvent action of water. Should it be on a plaster-wall or on wood, we must scrape or cut out a portion, and digest it in a small quantity of water in a tube or watch-glass. An unstained portion of the plaster or wood should also be examined. (See, on the subject of blood-stains, Ann. d'Hyg. 1829, pp. 267, 548; 1830, p. 433; 1831, p. 467; 1833, p. 226, t. 2. p. 160; 1834, p. 205; 1835, t. 2. p. 349; 1839, t. 1. p. 219; 1840, t. 1. p. 387: also, Heuke's Zeitschrift der S. A. 1844, b. 2. p. 273. See also, for a full account of this subject, Guy's Hosp. Reports, Oct. 1851.)

Insoluble stains.—Among insoluble stains are—1, certain *red dyes,* as madder, which, when fixed by a mordant, is not readily affected by ammonia. 2. *Iron Moulds.* These are of a reddish-brown colour, sometimes of a bright red,—they are quite insoluble in water, but are easily dissolved by diluted hydrochloric acid, and on adding ferrocyanide of potassium to the hydrochloric solution, the presence of iron will be at once apparent. Care should be taken that the acid used for this purpose contains no iron. The stained article of dress should also be proved to be free from any iron-dye, or a blood-stain might be erroneously pronounced to be due to iron. Some years since, a man was found drowned in the Seine, at Paris, under suspicious circumstances. The body had evidently lain a long time in the water. On examining the shirt of the deceased, a number of red-brown stains were observed on the collar and body,—resulting, as it was supposed, from spots of blood, which had become changed by time. On a chemical examination, however, they were found to be iron-moulds produced by the rusting of a steel-chain which the deceased had worn round his neck! 3. *Red paint.* Stains made with red paint containing peroxide of iron, have been mistaken for blood. They may be easily known by digesting them in diluted hydrochloric acid, and applying to the solution the tests for iron. Like those produced by iron-moulds, they are insoluble in water, and therefore cannot be confounded with blood-stains. The same may be said of spots of the ammonio-nitrate of silver changed by light, which I have known to be mistaken for old stains of blood. The stuff on which the spots of blood are found, may be itself stained with a red dye or colour, or it may be dyed with iron: in this case it will be necessary to test by the same process a piece of the coloured or stained portion, in order to furnish negative evidence that the suspected stains are due to blood. In *Spicer's* case (*ante*, p. 276), an apron which the prisoner wore was found with stains of blood upon it: but the greater part was covered with dark red stains, which turned out to be owing to a logwood-dye that the prisoner had used in his business. (Med. Gaz. vol. 37. p. 613.)

Soluble stains.—Among the soluble stains resembling those of blood, are the spots produced by the juices of the *mulberry*, *currant*, *gooseberry*, and other *red fruits*. These are commonly recognized by dropping on them a weak solution of ammonia,—when the spot is turned either of a bluish, olive-green, or green colour. The red of cochineal is changed to a crimson on the addition of ammonia or potash. A spot of blood thus treated undergoes no change from the alkali. Further, if a piece of the stained stuff is suspended in water, the coloured liquid, if any be obtained, is easily known from blood, by its acquiring a green or crimson tint on the addition of ammonia, and by the red colour not being *coagulated* or destroyed when the liquid is boiled. Independently of the fruits mentioned, there are many vegetable juices that will produce stains of a red or red-brown colour, which might be mistaken for blood. In one instance, the red petals of the poppy gave rise to an error only removed by a proper examination. (Bayard, Man. Prat. de Méd. Lég. 217.) In some red stuffs, the dye is often so bad, that water will dissolve out a portion of the colour: but in this case the action of ammonia and heat will serve readily to distinguish the stains from blood. The soluble red or brown stains given by woods or roots, such as *Logwood*, *Brazil-wood*, or *Madder-root*, are changed to a *crimson* colour by ammonia. They also generally contain tannic acid, and acquire a dark olive green colour when a persalt of iron is added to the liquid. Red-brown extracts, such as *Kino* and *Catechu*, are not affected by ammonia: but the colour given to water is different from that of blood, and the addition of a persalt of iron reveals the presence of tannic acid. [For a further account of the differences between red dyes and blood, see Guy's Hospital Reports, October 1851.]

Removal of blood stains.—An attempt may have been made to wash out blood-stains, so that the colour may be more or less changed, and no chemical evidence obtained. There is a common notion that certain chemical agents will remove or destroy these stains; but this is not the case,—the colour may be altered, but when dried on the stuff it is not easily discharged or bleached. Chlorine, a most powerful decolorizing agent, turns the colouring matter of blood of a green-brown colour. Hypochlorous acid has a similar effect. This acid has been recommended as useful by its bleaching properties for distinguishing the stain of blood from all other stains, excepting those produced by iron-rust. Orfila has, however, shown that it is not fitted for such a purpose, and that there are no better methods of testing than those above described. (Ann. d'Hyg. 1845, vol. 2, p. 112.) I have found that nothing removes a blood-stain, whether wet or dry, so effectually as simple maceration in *cold* water, although, when the stain is old, the process is sometimes slow.

Detection of blood on weapons.—When recent, and on a polished instrument, stains of blood are easily recognized; but when of old standing, or on a rusty piece of metal, it is a matter of some difficulty to distinguish them from the stains produced by rust or other causes. If the stain is large, a portion will readily peel off on drying. This may be placed in a watch-glass with some distilled water,—the solution filtered to separate any oxide of iron, and then tested. If the water by simple maceration does not acquire a red or red-brown colour, the stain is *not* due to blood. Sometimes the stain appears on a dagger or knife either in the form of a thin yellowish or reddish film, or in streaks, and is so superficial that it cannot be mechanically detached. We should then pour a stratum of water on a piece of plate-glass, and lay the stained part of the weapon upon the surface. The water slowly dissolves any portion of the colouring matter of blood, and this may be examined by the process recommended. If the weapon has been exposed to heat, this mode of testing will fail.

Objections.—There is often a remarkable resemblance to the stains of blood on metal, produced by the *oxide or certain vegetable salts of iron.* If the juice or pulp of lemon or orange be spread upon a steel-blade, and remain exposed to air for a few days, the resemblance to blood produced by the formation of *citrate of iron* is occasionally so strong that I have known well-informed surgeons to be completely deceived:—they have pronounced the spurious stain to be blood, while the real blood-stain on a similar weapon was pronounced to be artificial. The difficulty of distinguishing such stains by the eye, is well illustrated by a case which occurred in Paris a few years since. A man was accused of having murdered his uncle, to whose property he was heir. A knife was found in his possession, having upon it dark-coloured stains, pronounced by those who saw them to be stains of blood. M. Barruel, and another medical jurist, were required to determine the nature of the stains, and the examination was made before a magistrate in the presence of the accused. They were clearly proved, by these and other experiments, to be spots produced by the citrate of iron. It appeared on inquiry, that the knife had been used by some person a short time previously, for the purpose of cutting a lemon; and not having been wiped before it was put aside, a simple chemical action had gone on between the acid and the metal, which had given rise to the appearance. This case certainly shows that physical characters alone cannot be trusted in the examination of these suspected stains. Stains of the *citrate of iron* may be thus distinguished. The substance is soluble in water, forming, when filtered, a yellowish-brown solution, totally different from the red colour of blood under the same circumstances. The solution undergoes no change of colour on the addition of ammonia. It is unchanged in colour, but may be partially coagulated at a boiling temperature: and it is at once identified as a salt of iron, by giving a blue colour with the ferrocyanide, and a deep red with sulphocyanide of potassium. I have observed, that spots of the citrate of iron on knives, for they are not found on other weapons, are often soft and deliquescent, while those of blood are commonly dry and brittle.

It is not always easy to distinguish by sight a stain of blood on a weapon from a mark produced by *iron-rust*. When suspicion exists, marks are pronounced to be due to blood, which, under other circumstances, would have passed unnoticed. One source of difficulty is this: the iron-rust is often mixed with articles of food on an old knife, or even with blood itself. We must here pursue the same mode of examination as if the stain were of blood; we macerate the weapon or a portion of the coloured deposit in a small quantity of distilled water, and filter the liquid. If the stain is due to iron-rust this will be separated by filtration, and the liquid will pass through colourless. The absence of blood is thereby demonstrated: for I need not here consider the objection, that the weapon may have been exposed to heat, and thus have rendered the blood-stains insoluble in water. If we now digest the brown undissolved residue left on the filter, in diluted hydrochloric acid free from iron, we shall obtain a yellowish solution, which will give with the ferrocyanide and sulphocyanide of potassium the proper reactions for iron. It has been recommended to put the acid on the stained weapon, and then test the liquid, as the red spot of rust is soon removed by the acid: but a spot containing blood may be thereby pronounced to be one of rust only, since the acid, in all cases, dissolves a portion of iron, and the solution would give the characters of an iron-stain with the tests. In all old blood-stains, when the weapon is rusty, blood and oxide of iron are intermixed. The blood may be easily separated by digesting the compound in distilled water, and filtering the solution: the colouring matter is dissolved, and passes through, while the rust is left on the filter. Acetic acid will also dissolve the blood and leave the rust.

The following case was referred to me for examination a few years since. A man was suspected of murder, and some stains existed on his shirt, which were supposed to have been produced by blood. Around the collar and upper part of the shirt, there was a large and somewhat deep pinkish-red stain, in some respects resembling washed blood. This I considered as a very unusual situation for blood to be found sprinkled: and upon trying the stained linen by the processes mentioned, the colour entirely resisted separation by water, and was turned of a slight crimson tint by ammonia. The stain was thus shown not to be due to blood. On inquiry, it was ascertained that the man had worn round his neck a common red handkerchief during a wet night, and while taking violent exercise! The stain was thus accounted for. There were, however, some other marks on the shirt which required examination, as there was a very strong suspicion against this man. These were on the sleeves, at those parts which would be likely to receive stains of blood if they had been rolled or turned up at the wrists; and it was clearly ascertained that the murderer, in this case, used a quantity of yellow soap in washing his hands. These stains were of a brownish colour, without any shade of red; they were faint in parts and diffused, conveying the impression that an attempt had been made to wash them out. So far as external characters were concerned, it was difficult to say whether they had been produced by blood or not. On examining the parts of the shirt corresponding to the armpits, stains precisely similar were there seen, evidently resulting from cutaneous perspiration; since the suspicion of blood being effused on these parts of the shirt under the circumstances, could not be entertained. Slips of linen from the stained portions of the sleeves were digested in water. In twenty-four hours the stains were entirely removed; and the lower stratum of water in each tube had acquired a straw-yellow colour. There was not the least shade of a red or brown tint; and the solution was wholly unlike that produced by blood under any circumstances. The solution was unaffected by ammonia, as well as by a heat of 212°; but it acquired a faint opalescence on the addition of nitric acid. These results not only indicated the absence of blood, but showed that the stains were due to cutaneous perspiration issuing from a dirty skin, and through a dirty dress. The stains on the parts corresponding to the armpits could not be ascribed to blood; and from the similarity in physical and chemical properties, it was impossible to attribute those on the sleeves to any sanguineous effusion. It happened, however, that a large pocket-knife, with numerous dark red stains on the blade and between the layers of the handle, was found upon this man; and this was also sent for examination. Several persons who saw the knife pronounced a strong opinion that the marks were due to blood. The stains were composed of some soft viscid matter, which gave out ammonia when heated, and left a residue of peroxide of iron. On digesting the matter in water no portion was dissolved; and it was, therefore, evident that they were due not to blood, but to a mixture of some animal matter, probably food, with iron-rust. These results were somewhat in the man's favour,—at least, they removed what was considered to be a strong circumstantial proof of his guilt. He was subsequently tried for the murder, and acquitted on an alibi, established by the evidence for the prosecution.

Varieties of blood.—The means of distinguishing *arterial* from *venous* blood, available to the medical jurist, have been elsewhere described (see *ante*, p. 275). There is no method known by which the blood of a man can be distinguished from that of a woman, or the blood of a child from that of an adult. The blood of a child at birth contains less fibrin, and forms a thinner and softer coagulum than that of the adult. A medico-legal question has arisen on more than one occasion, whether there were any means of distinguishing *menstrual* blood from that of the body generally. This liquid contains fibrin, although the proportion is much less than in venous or arterial blood, red colouring matter, and the other constituents of blood. The only differences noticed are of an accidental kind:—1st, that it is acid, owing to its admixture with vaginal mucus; and 2nd, that under the microscope it is mixed up with epithelial scales, which it has derived from the mucous membrane in its passage through the vagina. (Donné, Cours de Microscopie, p. 139.) A case occurred in France, which induced the Minister of Justice to refer the consideration of this question to the Academy of Medicine. The reporters, MM. Adelon, Moreau, and Le Canu, came to the conclusion, that there were no means of distinguishing menstrual blood dried on clothing from that which might be met with in a case of infanticide or abortion. (Ann. d'Hyg. 1846, vol. 1. p. 181.)

Blood of man and animals.—Tests by odour.—When marks of blood have been detected on the dress of an accused person, it is by no means unusual to find these marks referred to his having been engaged in killing a pig or a sheep, or handling fish or dead game. Of course every allowance must be made for a statement like this, which can only be proved or disproved by circumstances; but an important question here arises, namely, whether we possess any *certain* means of distinguishing the blood of a human being from that of an animal. M. Barruel, and other French medical jurists, state that by mixing fresh blood with one-third or one-half of its bulk of strong sulphuric acid, and agitating the mixture with a glass rod, a *peculiar odour* is evolved, which differs in the blood of man and animals, and also in the blood of the sexes. This odour, it is said, resembles that of the cutaneous exhalation of the animal the blood of which was made the subject of experiment. They have hereby pretended to determine, whether any given specimen of blood belonged to a man, a woman, a horse, sheep, or fish. Others assert that they have been enabled by this process to identify the blood of frogs and fleas! (See Devergie, Méd. Lég. vol. 2, p. 907.) It is true that strong sulphuric acid does give rise to a particular odour when mixed with fresh blood, probably owing to its decomposing some of the animal principles; it is possible that some persons may discover a difference in the odour, if not according to the sex, at least according to the animal, — but even this point is far from being established: and if it were admitted, there is probably not one individual among a thousand, whose sense of smelling would be so acute as to allow him to state with *undeniable certainty*, from what animal the unknown blood had really been taken. Any evidence short of this would not be received in an English Court of law; for it is considered better not to decide at all than to decide on principles which are exposed to unavoidable fallacy. Besides, it must be remembered, that, in general the operator has not before him the fresh blood, but merely a diluted solution of the dried colouring matter mixed with a small quantity of serum. In a case of importance which occurred in Paris, the testing of blood by odour completely failed in the hands of M. Barruel and two other eminent French medical jurists, MM. Tardieu and Chevalier. The mistakes made by these experts are admitted by themselves to have been of so serious a nature as to render this mode of obtaining evidence in any future case inadmissible. (Annales d'Hyg. 1853, t. 1. p. 413.) For additional remarks on this subject, see paper in Guy's Hospital Reports, Oct., 1851.

Microscopical evidence.—The microscope has been of late years employed not only to distinguish blood from other coloured liquids, but for drawing a distinction between the blood of different classes of animals. The red colouring matter of blood consists of minute coloured globules or particles, floating in a clear liquid. Other red colouring matters, such as madder, cochineal, or lac, do not owe their colour to independent corpuscles or globules. Hence, if coloured globules, of the form and size of those found in mammalian blood, are visible under the microscope, there can be no doubt that the liquid is blood. Such evidence can, however, be safely received only from one who has been accustomed to the use of this instrument.

The examination of a blood-stain in the *dry* state may be made with a power of from twenty to thirty diameters. Coagula or clots not visible to the naked eye, will then plainly appear. These will be found to have a rich crimson-red colour in the thinner portions: the tint, when compared with other red colouring matters, is sufficiently peculiar to enable the examiner to form an opinion, whether the stain is or is not owing to blood. The discovery of coagula or clots, fixed in the fibres of the stuff, is also a strong proof of the stain being caused by blood. Red colours do not give this clotted appearance; but they have merely that of a dried dye, tinging the stuff uniformly without stiffening the fibre. Small portions of *kino* derived from a solution of that extract, have presented a very strong resemblance to coagula or clots of blood. The action of a persalt of iron on a solution of the stain in water, by striking a greenish black colour, will, however, show that this extract is really the cause of the stain.

In order to examine the stain for globules, a portion of it cut out, or what is better a small fragment of the supposed clot, should be placed on a glass slide, and moistened either with distilled water, or with pure glycerine sufficiently diluted with water to render it a good substitute for the serum of blood, *i. e.* brought to a sp. gr. of about 1·030. After a short time, the liquid, supposing the stain to be owing to blood, will acquire a reddish or reddish-brown colour. A piece of thin microscopic glass should then be placed over it, and the liquid examined by a power of from 260 to 300 diameters. If the stain is owing to *mammalian blood*, the globules will present a rounded or (in some aspects) lenticular form, and a pale yellowish or reddish colour. They may be measured by the micrometer. Some articles of dress yield starch-granules—care must be taken not to confound these with blood-globules. Water alters the size and shape of the latter; hence various liquids have been recommended for separating them from the clot. A solution of sugar, potash, of sulphate of soda, phosphate of soda, common salt, oil and albumen, have been successively employed; but these are evaporable liquids; they become dry and interfere with the observations. By the use of glycerine, I obtained clear evidence of the existence of globules in a minute fragment of blood which had been kept in a dried state for a period of *three years*. (See Ann. d'Hyg., 1859, t. 2. p. 151; also 1860, t. 1. p. 416.)

The microscope has been chiefly employed with the view of determining whether the blood is that of a *human being* or *an animal*. This question is constantly arising in criminal investigations. When blood is detected on the dress of a person charged with the death of another, it is frequently asserted in the defence, that the blood-stains were caused by his having killed a hare, a pig, a sheep, or a bullock, or by his having accidentally handled the dead carcase of some animal. In a few cases, the situation of these stains on different and remote parts of the dress, back and front, as well as in concealed or covered parts, may show that the defence is inconsistent with the facts; but in the large majority, a medical witness will be required to state whether the blood is or is not human. It has been already observed that there are no *chemical* differences between the blood of man and animals. The red colouring matter, the albumen and fibrin, are the same, and chemical tests produce on them precisely similar results. The *microscopical* differences refer to the *shape* and *size* of the globules. 1. With respect to *shape*. In all animals with red blood, the globules have a disc-like or flattened form. In the mammalia, excepting the camel tribe, the outline of the disc is *circular*. In this tribe, and in birds, fishes, and reptiles, the globules have the form of a lengthened ellipse or *oval*. In the three last mentioned classes of animals they have a central nucleus, which gives to them an apparent prominence in the centre. The blood-globules of all the mammalia, including those of the camel tribe, have no central nucleus, and they appear depressed in the centre.

The microscope, therefore, enables the observer to distinguish the blood of birds and fishes from that of a human being; and this is often of great importance as evidence. In *Reg.* v. *Drory* (Essex Lent Assizes, 1851), it was suggested in the defence, that the blood-stains on the clothes of the prisoner had been caused by his having killed some chickens. The shape of the globules negatived this part of the defence. In another case the blood was alleged to be that of a fish; this was also disproved by the shape. Water causes an alteration in the shape of the oval corpuscle, rendering it larger and giving to it a circular outline. Dr. Bennett states that on one occasion he was called to see a patient (labouring under bronchitis) who was spitting florid blood. On examining the sputum with a microscope, he found that the coloured blood-corpuscles were those of a bird. On his telling the patient that she had mixed a bird's blood with the expectoration, she was astounded, and confessed that she had done so for the purpose of imposition. (The Microscope as a Means of Diagnosis, p. 185.)

The chief microscopical distinction between the *blood of man and domestic animals*, consists in a difference in the *size* of the globules. This, however, is only an *average* difference; for the globules are found of different sizes in the blood of the same animal. In making use of this criterion, it would be necessary to rely upon the size of the majority of the corpuscles seen in a given area, and under the same power of the microscope. It is a curious fact that the size of these globules in the blood bears no relation to the size of the animal. Thus in the horse, ox, ass, cat, mouse, pig, and bat, they are on the average nearly of the same size; the difference is so slight as to be practically inappreciable. In these animals they are smaller than in man, and in several of the mammalia. The corpuscles in man, the dog, the rabbit, and the hare, are of nearly the same size. In the blood of the sheep and goat, they are smaller than in other mammalia. The size of the corpuscle bears no proportion to the age of the animal: thus in the blood of the human fœtus they are to be found as large as in that of the adult.

The measured diameter of the globules in *human blood* varies, according to Gulliver, from 1-2000th to 1-4000th of an inch, the average size in both sexes being 1-3200th of an inch. From an examination of various specimens of human blood, I have found the average diameter of the globules to be the 1-3500th of an inch, the maximum size being 1-3000th, and the minimum 1-5000th of an inch. The globules of human blood are larger than those of domestic animals. The subjoined measurements, in fractions of an inch, are those given by Mr. Gulliver, excepting the figures in brackets which are from my own micrometrical observations. The average diameter is, in the dog, 1-3540th (max. 1-4000th, min. 1-6000th),—in the hare, 1-3607th (1-4000th; max. 1-2000th, min. 1-8000th),—in the mouse, 1-3814th,—in the ass, 1-4000th—(rabbit 1-4000th),—in the pig, 1-4230th (1-4250th),—in the ox, 1-4267th,—(in the cow, 1-4000th to 1-4200th),—in the cat, 1-4400th,—in the horse, 1-4600th (1-5000th),—in the sheep, 1-5300th (1-5333rd to 1-6000th),—in the goat, 1-6366th.

These measurements apply to *recent* blood which has not been allowed to dry on animal and vegetable stuffs. In this case a distinction might be made between the blood of a human being and a sheep. With respect to the dog, hare, and rabbit, it would be, even under these favourable circumstances, a matter of difficulty. When blood is dried on clothing, and it is necessary to extract the corpuscles by means of a liquid of a different nature from the serum, we cannot rely upon slight fractional differences, since we cannot be sure that the globules, after having been dried, will ever reacquire in a foreign liquid the exact size which they had in serum. Medical evidence must therefore be based in such cases on mere speculation. (See Guy's Hospital Reports, vol. 7. pt. 2. 1851.) Dr. Schmidt has proposed to dry the corpuscles of each animal, to measure them in their dried or shrivelled state, and to compare the suspected blood (also dried) with these various samples. (Die Diagnostik verdächtigen Flecken in Kriminalfällen, Leipzig, 1848.) I have tried this process, but have not found it practically available. In the present state of science the question must in my opinion be regarded as unsolved. When blood has been *dried* on clothing, we cannot, with certainty and accuracy, distinguish that of an ordinary domestic animal from the blood of a human being. The extent to which a medical witness is justified in going on such occasions appears to me to be this. The size and shape of the corpuscles are consistent with their being the corpuscles of human blood: but it is impossible in the present state of science to affirm that the corpuscles extracted from stains dried on clothing or weapons are not those of some domestic animal. This was the substance of the evidence which I gave in the case of *Reg.* v. *Munro* (Cumberland Lent Assizes, 1855), a case in which everything turned on circumstantial evidence of a medical and moral kind. I declined to say absolutely that the stains were caused by human blood, although the corpuscles coincided in measurement with them. In one instance a medical witness professed to make a distinction between certain spots on a man's clothes,—assigning some to the blood of a horse, and others to human blood; but in criminal jurisprudence no one has probably gone so far as Mr. Herapath in a case, on some points of which I have elsewhere commented. (*Reg.* v. *Nation*, Taunton Spring Assizes, 1857, see p. 279: also, Med. Times and Gazette, April 11, 1857, p. 365.) For information on this important subject, see Ritter's Prize Essay, Ueber die Ermittelung der Blutflecken in Kriminalfällen, Wurzberg, 1854, and Friedberg's Histologie des Blutes, Berlin, 1852. These authors affirm from their observations, that it is not possible to distinguish by the microscope human from animal blood in criminal cases. Evidence based upon such varying averages as those above given, must be treated as speculative and unsafe.

CHAPTER 29.

DEATH OF WOUNDED PERSONS FROM NATURAL CAUSES—DISTINCTION BETWEEN REAL AND APPARENT CAUSE—DEATH FROM WOUNDS OR LATENT DISEASE—ACCELERATING CAUSES—WHICH OF TWO WOUNDS CAUSED DEATH?—DEATH FOLLOWING SLIGHT PERSONAL INJURIES.

Death of wounded persons from natural causes.—It is by no means unusual for individuals who have received a wound, or sustained some personal injury, to die from latent natural causes; and as, in the minds of non-professional persons, death may appear to be a direct result of the injury, the case can only be cleared up by the assistance of a medical practitioner. Such a coincidence has been witnessed in many instances of attempted suicide. A man has inflicted a severe wound on himself while labouring under disease; or some morbid change, tending to destroy life, has occurred subsequently to the infliction of a wound, and death has followed. Without a careful examination of the body, it is impossible to refer death to the real cause. The importance of an accurate discrimination in a case in which wounds or personal injuries have been caused by another, must be obvious on the least reflection; a hasty opinion may involve an accused party in a charge of manslaughter; and although a barrister might be able to show on the trial that death was probably attributable not to the wound, but to coexisting disease, yet it must be remembered, that the evidence of a surgeon before a coroner or magistrate, in remote parts of this country, may be the means of causing the accused to be imprisoned for some months previously to the trial. This is in itself a punishment, independently of the loss of character, to which the accused must be in the mean time exposed. In Guy's Hospital Reports, Oct. 1850, p. 230, will be found two cases communinicated to me by Mr. Procter, of York, in which death from natural causes was wrongly assigned to violence. In a case, reported by Dr. Berncastle (Lancet, Feb. 15, 1845, p. 185), the deceased, a boy, died, from internal strangulation of the intestine from morbid causes, after wrestling with another boy, who might, but for the inspection, have been erroneously charged with having caused his death. (For a similar case, see Medical Gazette, vol. 37. p. 702; also Casper's Wochenschrift, May 24, 1845.)

Death from wounds or latent disease.—A natural cause of death may be lurking within the body at the time that a wound is criminally inflicted, and a close attention to the symptoms and appearances after death can alone enable a medical man to distinguish the real cause. A man may be severely wounded, and yet death may take place from rupture of the heart, the bursting of an aneurism, from apoplexy, phthisis, or other morbid causes which it is here unnecessary to specify. (Cormack's Ed. Jour. May, 1846, p. 343.) If death can be clearly traced to any of these diseases by an experienced surgeon, the prisoner cannot be charged with manslaughter: for the medical witness may give his opinion that death would have taken place about the same time and under the same circumstances whether the wound had been inflicted or not. The case of *Colonel Gordon*, which occurred in April, 1854, proves that slight causes may lead to death, when there is latent disease of the heart or any other important organ. This case was the subject of a trial at the Chester Lent Assizes, 1854 (*Reg.* v. *Sandars*). It appeared from the evidence, that the accused, who was the conductor of a railway train in which deceased was travelling, attempted to eject him from a carriage. The deceased resisted, and in the struggle the prisoner struck him on the left arm. The deceased made no further resistance, but sat quietly in his seat. It was soon afterwards perceived that he was dead. The medical evidence showed that there was ossification of the valves of the heart and aorta, and that this disease had been of long standing. The life of the deceased was at all times in great peril, and his death might have arisen from the excitement which took place previous to the prisoner laying hands upon him. It might have followed in the course of half an hour. As it was thus admitted that excitement alone would account for the fatal result, the prisoner was acquitted. There was no *corporeal* injury done to the deceased which could account for death.

In another case, which was the subject of a trial at the Central

Criminal Court, in June, 1854 (*Reg.* v. *Champlonier*), appearances sufficient to account for death existed in the part which sustained the violence; but the medical witness could not with certainty refer them to the violence. An old man passing along a road was struck on the forehead by a stone thrown by the prisoner. The surgeon stated that there was a contused wound, and that his nose bled profusely. The bleeding was arrested, and on the following day he considered the deceased to be out of danger. At a later period of the day, however, the deceased was seized with an apoplectic fit, from which he did not recover. The appearances in the brain were quite sufficient to account for death; but he could not undertake to say that the injury by the stone had in any way produced the appearances. Upon this evidence the supposed connection of the death with the violence was at once set aside, and the prisoner was discharged.

On these occasions, one of the following questions may arise:—Was the death of the party accelerated by the wound, or was the disease under which he was labouring, so aggravated by the wound as to produce a more speedily fatal termination? The answer to either of these questions must depend on the circumstances of the case, and the witness's ability to draw a proper conclusion from these circumstances. The maliciously accelerating of the death of another already labouring under disease is criminal; for that which accelerates, causes. Lord Hale, in remarking upon the necessity of proving that the *act* of a prisoner caused the death of a person, says:—"It is necessary that the death should have been occasioned by some corporeal injury done to the party by force, or by poison, or by some *mechanical means* which occasion death; for although a person may, *in foro conscientiæ*, be as guilty of murder by working on the passions or fears of another, and as certainly occasion death by such means, as if he had used a sword or pistol for the purpose, he is not the object of temporal punishment." (I. 247.) Several acquittals have taken place of late years, in cases in which the deaths of parties had been occasioned by terror, or dread of impending danger, produced by acts of violence on the part of the prisoners; not, however, giving rise to bodily injury in the deceased. Conformably to Lord Hale's view, the Criminal Law Commissioners in their report on the subject of homicide, state:—"Art. 1. The law takes no cognizance of homicide unless death result from *bodily injury* occasioned by some act or *unlawful omission*, as contradistinguished from death occasioned by an influence on the mind, or by any disease arising from such influence. Art. 2. The terms 'unlawful omission' comprehend every case where any one being under legal obligation to supply food, clothing, or other aid and support, or to do any other act, or make any other provision for the sustentation of life, is guilty of any breach of such duty."

Under the statute (1 Vict. c. 85, s. 2) it appears from the following case that physical injury only is intended. In *Reg.* v. *Grey* (Huntingdon Lent Assizes, 1857), the prisoner was indicted for causing a bodily injury dangerous to life—to wit, a congestion of the lungs and heart, with intent to murder. It appeared that she had exposed her child to cold and wet, and that congestion or inflammation of the lungs was a result of such exposure. Erle, J., held that the statute under which the indictment was laid contemplated the infliction of some wound or visible injury to the person. The woman was found guilty; but in June, 1857, the point having been reserved, the conviction was quashed by the Court for Crown Cases reserved, on the ground that, looking to the other offences provided for in this statute, this case did not come within it. In *Reg.* v. *Percival* (Midland Circuit, March, 1857), a man was charged with the manslaughter of deceased by causing his death from fright, *i. e.* by personating a ghost. The evidence showed that the boy had sustained no physical injury, but he had received a shock from which he did not recover. Wightman, J., held that in his view the case would fall within the definition of manslaughter. Under the 14 and 15 Vict., c. 100, the necessity for tracing death to some *corporeal* injury appears to be practically abolished. According to the fourth section, in any future indictment for murder or manslaughter it shall not be necessary to set forth the *manner* or the *means* by which the death of the deceased was caused.

Which of two wounds caused death.—It is possible that a man may receive *two wounds* on provocation, at different times, and from different persons, and die after receiving the second: in such a case, the course of justice may require that a medical witness should state which wound was the cause of death. Let us take the following illustration:—A man receives during a quarrel a gun-shot wound in the shoulder. He is going on well, with a prospect of recovery, when in another quarrel he receives a severe penetrating wound in the chest or abdomen from another person, and after lingering under the effects of these wounds for a longer or shorter period, he dies. If the gun-shot wound was clearly shown to have been the cause of death, the second prisoner could not be convicted of manslaughter: or if the stab were evidently the cause of death, the first prisoner would be acquitted on a similar charge. It might be possible for a surgeon to decide the question summarily, when, for instance, death speedily followed the second wound: and on inspection of the body, the heart or a large vessel is discovered to have been penetrated; or, on the other hand, extensive sloughing sufficient to account for death, might take place from the gun-shot wound, and on inspection, the stab might be found to be of a slight nature,—not involving any vital parts. In either of these cases, all would depend upon the science, skill, and judgment of the medical practitioner,—his evidence would be so important that no correct decision could be arrived at without it; he would be, in fact, called upon substantially to distinguish the guilty from the innocent. On some occasions death may appear to be equally a consequence of either or of both of the wounds; in which case, probably both parties would be liable to a charge of manslaughter, (See Ann. d'Hyg. 1835, vol. 2. p. 432.) The second wound, which is here supposed to have been the act of another, may be inflicted by a wounded person on himself. in an attempt at suicide, or it may have an accidental origin. The witness would then have to determine whether the wounded person died from the wound inflicted by himself or from that which he had previously received. (See *Tetanus*, post.)

It may happen that the wounded person has taken *poison*, and actually died from the effects of this, and not from the injuries or maltreatment. Cases of this kind have been already related (page 224). Again: a wounded person may have been the subject of further ill-treatment, and the question will arise to which of the two causes his death was really due. It is to be observed of these cases, that the supervening disease, the poison, or the subsequent ill-treatment, should be of such a nature as to account for *sudden or rapid death;* since it would be no answer to a charge of death from violence, to say that there were marks of chronic disease in the body, unless it was of such a nature as to account for the sudden destruction of life under the symptoms which actually preceded death. In the medical jurisprudence of wounds, there is probably no question which so frequently presents itself as this: it is admitted that the violence was inflicted, but it is asserted that death was due to some other cause: and the onus of proof lies on the medical evidence. Among numerous cases which have occurred in England during the last twenty years, I find that the latent causes of death in wounded persons have been chiefly inflammation of the thoracic or abdominal viscera, of apoplexy, diseases of the heart and large blood-vessels, phthisis, ruptures of the stomach and bowels from disease, internal strangulation, and the rupture of deep-seated abscesses. In some of these cases the person was in a good state of health up to the time of the violence, and in others there was a slight indisposition. The history is nearly the same in all: it was only by careful conduct on the part of the medical witnesses that the true cause of death was ascertained. It is obvious that questions of malapraxis and life-insurance, giving rise to civil actions, may have a close relation to this subject.

Death following slight personal injuries.—An imputation has occasionally been thrown on the master of a school, when a boy has died soon after he has been punished in an ordinary way, and when there has been no suggestion that an undue amount of violence was used. In such cases there has been commonly some unhealthy state of the body to explain this result. When the disease which gives rise to doubt is seated in a part which is remote from that which sustained the violence, all that is required is, that the examination of the body should be conducted with ordinary care. If the disease should happen to be in the part injured (the head or chest), the case is more perplexing. The difficulty can then be removed only by attentively considering the ordinary consequences of such injuries. The violence may have been too slight to account for the diseased appearance; and the disease itself, although situated in the part injured, may be regarded as an unusual consequence of such an injury. On the other hand, the presence of chronic disease will form no exculpation of acts of violence of this nature. In *Reg.* v. *Hopley* (p. 290), there was chronic disease of long standing in the brain of deceased, but it was proved that he was quite well and suffered from no unusual symptoms up to the time that the violent flogging was inflicted, and that this was followed by death in less than three hours from the commencement of the violence. It was not here a question even of acceleration, for the deceased might have lived for years in spite of the existence of this chronic disease.

CHAPTER 30.

WOUNDS INDIRECTLY FATAL — DEATH FROM WOUNDS AFTER LONG PERIODS — SECONDARY CAUSES OF DEATH — THE CAUSE IS UNAVOIDABLE — THE CAUSE AVOIDABLE BY GOOD MEDICAL TREATMENT — COMPARATIVE SKILL IN TREATMENT — CAUSE AVOIDABLE BUT FOR IMPRUDENCE ON THE PART OF THE WOUNDED PERSON — ABNORMAL OR UNHEALTHY STATE OF BODY — ACCELERATION OF DEATH.

Wounds indirectly fatal. — Certain kinds of injuries are not immediately followed by serious consequences, but the person may perish after a longer or shorter period of time, and his death may be as much a consequence of the injury as if it had taken place on the spot. The aggressor, however, is just as responsible as if the deceased had been directly killed by his violence, provided the fatal result can be traced to the usual and probable consequences of the injury. Wounds of the head are especially liable to cause death insidiously: the person may in the first instance recover,—he may appear to be going on well, when, without any apparent cause, he will suddenly expire. It is scarcely necessary to observe, that in general an examination of the body will suffice to determine whether death is to be ascribed to the wound or not. In severe injuries affecting the spinal marrow, death is not an immediate consequence, unless that part of the organ which is above the origin of the phrenic nerves be wounded. Injuries affecting the lower portion of the spinal column do not commonly prove fatal until after some days or weeks ; but the symptoms manifested by the patient during life, as well as the appearances observed in the body after death, will sufficiently connect the injury with that event. Death may follow a wound, and be a consequence of that wound, at almost any period after its infliction. It is necessary, however, in order to maintain a charge of homicide against an individual, that death should be strictly and clearly traceable to the injury, and not be dependent on any other cause. A doubt on this point must, of course, lead to an acquittal.

Death from wounds after long periods.—Many cases might be quoted in illustration of the *length of time* which may elapse before death takes place from certain kinds of injuries,—the injured party having ultimately fallen a victim to their indirect consequences. A case is related by Sir A. Cooper, of a gentleman who died from the effects of an injury to the head received about *two years* previously. The connection of death with the wound was clearly made out by the continuance of the symptoms of cerebral disturbance during the long period which he survived.

There is a singular rule in our law relative to the period at which an individual dies from a wound—namely, that a party shall not be adjudged guilty of homicide, unless death takes place *within a year and a day* after the infliction of a wound. (Archbold, p. 345.) In practice, the existence of this rule is of little importance, but in principle it is erroneous. Most wounds leading to death generally destroy life within two or three months after their infliction :—sometimes the person does not die for five or six months, and, in more rare instances, death does not ensue until after the lapse of twelve months, or even several years. These protracted cases occur especially in respect to injuries of the head. In *Reg.* v. *Hynes* (Winchester Summer Ass., 1860), it was proved that the prisoner had inflicted severe wounds on the head of deceased, and that death took place *two months* afterwards. The medical witnesses were perfectly agreed that death was caused by an abscess in the brain as a result of these wounds. The jury had great difficulty in finding a verdict of guilty, because in their opinion too long a time had elapsed for the injuries to have been the cause of death! But for the firmness of the judge, the prisoner would have escaped conviction, and would have owed that escape to the profound ignorance of the jury who tried him. Strict justice demands that the responsibility of a person who has inflicted a wound should depend upon its having really caused death, and not upon the precise period at which death takes place; for this must be a purely accidental circumstance.

Secondary causes of death.—A person who recovers from the immediate effects of a wound may die from fever, inflammation or its consequences, erysipelas, delirium tremens, tetanus, or gangrene; or an operation required during the treatment of a wound may prove fatal. These are what may be called secondary causes of death, or secondary consequences of a wound. The power of deciding on the responsibility of an accused person for an event which depends only in an indirect manner on an injury originally inflicted by him, rests of course with the authorities of the law. But it is impossible that they can decide on so difficult and nice a question in the absence of satisfactory medical evidence; and on the other hand, it is right that a medical witness should understand the importance of the duty here required of him. *Fever* or *erysipelas* may follow many kinds of serious wounds, and in some few instances be distinctly traceable to them; but in others, the constitution of a person may be so broken up by dissipated habits as to render a wound fatal which in a healthy subject might have run through its course mildly, and have healed. When the fever or erysipelas can be traced to a wound, and there is no other apparent cause of aggravation to which either of these disordered states of the body can be attributed, they can scarcely be regarded by a medical practitioner as unexpected and unusual consequences, especially when the injury is extensive, and seated in certain parts of the body, as in the scalp. If death take place under these circumstances, the prisoner will be held as much responsible for the result as if the wound had proved directly mortal. This principle has been frequently admitted by our law, and, indeed, were it otherwise, many reckless offenders would escape, and many lives would be sacrificed with impunity. It is, however, difficult to lay down general rules upon a subject which is liable to vary in its relations in every case; but when a wound is not serious, and the secondary cause of death is evidently due to constitutional peculiarities from acquired habits of dissipation, the ends of justice are probably fully answered by an acquittal: in fact, such cases do not often pass beyond a coroner's inquest.

The secondary causes of death may be arranged under the following heads:—

1. *The cause is unavoidable.*—Of this kind are tetanus, following laceration of tendinous and nervous structures,—erysipelas following lacerated wounds of the scalp,—peritoneal inflammation following rupture of the bladder or intestines, with effusion of their contents,—strangulation of the intestines, as phrenic hernia, following rupture of the diaphragm, and others of the like nature. Here, supposing proper medical treatment and

regimen to have been pursued, the secondary cause of death was unavoidable, and the fatal result certain.

2. *The cause avoidable by good medical treatment.*—There are, it is obvious, many kinds of wounds which, if properly treated in the first instance, may be healed, and the patient recover, but when improperly treated, they prove fatal. In the latter case, it will be a question for a witness to determine how far the treatment aggravated the effects of the violence, and from his answer to this the jury may have to decide on the degree of criminality which attaches to a prisoner. Let us suppose, for instance, that an ignorant person has removed a clot of blood, which sealed up the extremity of a vessel, in consequence of which fatal bleeding has ensued,—or that he has caused death by unnecessarily interfering with a penetrating wound of the chest or abdomen,—it would scarcely be just to hold the aggressor responsible, since, but for the gross ignorance and unskilfulness of his attendant, the wounded person might have recovered from the effects of the wound. When death is really traceable to the negligence or unskilfulness of a surgeon who is called to attend on a wounded person, this circumstance ought to be, and commonly is, admitted in mitigation, supposing that the wound was not originally of a mortal nature. Lord Hale observes: "It is sufficient to constitute murder, that the party dies of the wound given by the prisoner, although the wound was not originally mortal, but became so in consequence of negligence or unskilful treatment; but it is otherwise where death arises not from the wound, but from unskilful applications or operations used for the purpose of curing it." (I. 428.) The medical jurist will perceive that a very nice distinction is here drawn by this great judge, between death as it results from a wound rendered mortal by improper treatment, and death as it results from improper treatment, irrespective of the wound. In the majority of cases such a distinction could scarcely be established, except upon speculative grounds, and in no case, probably, would there be any accordance in the opinions of medical witnesses. In slight and unimportant wounds, it might not be difficult to distinguish the effects resulting from bad treatment from those connected with the wound, but there can be few cases of severe injury to the person, wherein a distinction of this nature could be safely made; and the probability is, that no conviction for murder would now take place, if the medical evidence showed that the injury was not originally mortal, but only became so by unskilful or improper treatment. In such a case, it would be impossible to ascribe death to the wound, or to its usual or probable consequences,—and without this it is not easy to perceive on what principle an aggressor could be made responsible for the result.

3. *Comparative skill in treatment.*—If death be owing to a

wound, it signifies not that, under more favourable circumstances, and with *more skilful treatment*, a fatal result might have been averted. As an illustration, the following case, reported by Alison, may be quoted:—The prisoner was one of a party of smugglers who fired at an officer of excise. The wounded man was carried to the nearest village, where he was attended by a surgeon of the country, who was not deficient in attention; but a great collection of matter having formed in the leg, fever ensued, and the patient died at the end of three weeks. In defence, it was urged that, by *skilful* treatment, the man might have recovered; but the Court held that it was incumbent to prove that death arose *ex malo regimine*. The true distinction in all such cases is, that if the death was evidently occasioned by grossly erroneous medical treatment, the original author of the violence will not be answerable; but if it arise from the want merely of the higher skill which can only be commanded in great towns, he will be responsible, because he has wilfully exposed the deceased to a risk from which he had practically no means of escaping. (Criminal Law of Scotland, p. 150.) In the case of *Macewan* (Perth, Sept. Circ. 1830), the prisoner was indicted for the manslaughter of a boy, by striking him a blow on the shoulder, which dislocated the arm. Two days after the blow, an ignorant bone-setter was consulted, and owing to his manipulations, inflammation took place, and the boy being of a sickly and scrofulous habit, this proved fatal. Under the direction of Lord Meadowbank the prisoner was acquitted. In charging the grand jury, in reference to *Mr. Seton's* case (Winchester Aut. Ass. 1845), Platt, B., is reported to have observed, that if a man inflict a wound likely to produce death, and the wounded party should fall into the hands of an unskilful practitioner, whereby death was hastened, the aggressor would still be responsible for the result. If the wound had not been likely to produce death, but by unskilful treatment death ensued, then that would not be murder. A case of this kind was tried at the Lewes Summer Assizes, 1858 (*Reg.* v. *Kingshoot*). A man in a quarrel received a bite on his thumb. He went to a quack, who applied some irritating ointment, which led to severe inflammation, and this rendered amputation of the arm necessary. He died from the effects of the operation. There was evidence that the original injury was slight, and would probably have healed but for the improper applications. On this evidence the prisoner was acquitted.

It will be obvious that a serious responsibility is thrown on practitioners who undertake the management of cases of criminal wounding. Any deviation from common practice should therefore be made with the greatest caution, since novelties in practice will, in the event of death, form one of the best grounds of defence in the hands of a prisoner's counsel. On these occasions every point connected with the surgical treatment will be rigorously inquired into. In the case of a severe lacerated wound to the hand or foot, followed by fatal tetanus, it may be said that the wounded person would not have died had amputation been performed. In this instance, however, a practitioner may justify himself by showing either that the injury was too slight to require amputation, or that the health or other circumstances connected with the deceased would not allow of its being performed with any reasonable hope of success. On the other hand, if the practitioner performed amputation, and the patient died, then it would be urged that the operation was unjustifiable and had caused death. Here the surgeon is bound to show that the operation was necessary, according to the ordinary rules of treatment. The treatment of severe incised wounds of the throat, when the trachea is involved, sometimes places a practitioner in an embarrassing position. If the wound is left open, death may take place from bleeding; if it be prematurely closed, blood may be effused into the windpipe, and cause death by suffocation.

4. *The cause avoidable but for imprudence or neglect on the part of the wounded person.*—A man who has been severely wounded in a quarrel, may obstinately refuse medical assistance, or he may insist upon taking exercise, or using an improper diet, contrary to the advice of his medical attendant; or, by other imprudent practices, he may thwart the best conceived plans for his recovery. The neglect to call in a medical practitioner, or the refusal to receive medical advice, will not, however, according to the decision in *Reg.* v. *Thomas* (Gloucester Aut. Ass. 1841), be considered a mitigatory circumstance in favour of the prisoner, even although the wound was susceptible of being cured. A man may receive a lacerated wound of an extremity, which is followed by tetanus or gangrene, and thus prove fatal: he may have declined receiving medical advice, or have obstinately refused amputation, although proposed by his medical attendant; but this would not be received as a mitigatory circumstance on the part of a prisoner; because the wounded person is not compelled to call for medical assistance, or to submit to an operation, and a medical witness could not always be in a condition to swear that the operation would have positively saved his life; he can merely affirm that it might have afforded to the deceased a chance of recovery. In the case of the *Queen* v. *Hulme* (Liverpool Aut. Assizes, 1843), it was proved that the deceased had died from tetanus, caused by an injury to a finger some time before. Amputation was advised by the surgeon, but the deceased would not consent to the operation. The prisoner was convicted of manslaughter, and sentenced to the severest punishment prescribed by the law for that crime.

5. *The cause avoidable but for an abnormal or unhealthy state*

of the body of the wounded person.—Wounds which are comparatively slight sometimes prove indirectly fatal, owing to the person being in an unhealthy state at the time of their infliction. In bad constitutions, compound fractures or slight wounds, which in a healthy subject would have a favourable termination, are followed by gangrene, fever, or erysipelas, proving fatal. Here the responsibility of an assailant for the death may become reduced, so that, although found guilty of manslaughter, a mild punishment might be inflicted. The consequence may be, medically speaking, unusual or unexpected, and, but for circumstances wholly independent of the act of the accused, would not have been likely to destroy life. In general, in the absence of malice, this appears to be the point to which the law closely looks, in order to make out the responsibility of the accused — namely, that the fatal secondary cause must be something not unusual or unexpected as a consequence of this particular injury; and the medico-legal question presents itself under this form: — Would the same amount of injury have been likely to cause death in a person of ordinary health and vigour? Men who have suddenly changed their habits of living, and have passed from a full diet to abstemiousness, are unable to bear up against comparatively slight injuries, and often sink from the secondary consequences. So a man otherwise healthy labouring under rupture, may receive a blow in the groin, attended with rupture of the intestine, gangrene and death, — another with a calculus in the kidney may be struck in the loins, and die in consequence of the calculus perforating the renal vessels and causing fatal hæmorrhage, or from subsequent inflammation. In the case of *Bennett* v. *Gredley* (Exchequer Sittings, Hilary Term, 1854), which was a suit for compensation by reason of injuries inflicted on a boy's arm, it was urged in defence that the state of the arm was partly owing to a former injury: in reference to which the Chief Baron remarked, that a man was not bound to have his body in so sound and healthy a state as to warrant an unauthorized assault upon him. A man, therefore, who commits an unauthorized assault upon his fellow-man must take his chance of the effects which such an assault may produce.

Acceleration of death.—It must be evident that there exist numerous other internal diseases, such as aneurism, and various morbid affections of the heart and brain, which are liable to be rendered fatal by *slight* external violence. Now, the law, as applied to these cases, is thus stated by Lord Hale:—"It is sufficient to prove that the death of the party was accelerated by the malicious act of the prisoner, although the former laboured under a mortal disease at the time of the act." (1. 428.) In those cases in which a slight degree of violence has been followed by fatal consequences, it is for a jury to decide, under all the circumstances, upon the actual and specific intention of the prisoner at the time of the act which occasioned death. And, according to Starkie, "it seems that in general, notwithstanding any facts which tend to excuse or alleviate the act of the prisoner, if it be proved that he was actuated by prepense and deliberate malice, and that the particular occasion and circumstances upon which he relies were sought for and taken advantage of merely with a view to qualify actual malice, in pursuance of a pre-conceived scheme of destruction, the offence will amount to murder." In most of these cases there is an absence of intention to destroy life: but the nature of the wound, as well as the means by which it was inflicted, will often suffice to develope the intention of the prisoner. An accurate description of the injury, if slight, may afford strong evidence in favour of a prisoner, since the law does not so much regard the means used by him to perpetrate the violence, as the actual intention to kill, or to do great bodily harm. Serious injury, causing death by secondary consequences, will admit of no exculpation when the prisoner was aware, or ought to have been aware, of the condition of the party whom he struck. Thus, if a person notoriously ill, or a woman while pregnant, be maltreated, and death ensue from a secondary cause, the assailant will be held responsible; because he ought to have known that violence of any kind to persons so situated must be attended with dangerous consequences. So, if the person maltreated be an infant, or a decrepit old man, or one labouring under a mortal disease, it is notorious that a comparatively slight degreee of violence will destroy life in these cases; and the prisoner would properly be held responsible. A wound which *accelerates* death *causes* death, and may therefore render the aggressor responsible for murder or manslaughter, according to the circumstances. The Commissioners appointed to define the criminal law on the subject of homicide thus express themselves: — "Art. 3. It is homicide, although the effect of the injury *be merely to accelerate the death* of one labouring under some previous injury or infirmity, or although, if timely remedies or skilful treatment had been applied, death might have been prevented." This is conformable to the decisions of our judges. According to Lord Hale, if a man have a disease which in all likelihood would terminate his life in a short time, and another give him a wound or hurt which hastens his death, this is such a killing as constitutes murder. (Archbold, p. 345.)

CHAPTER 31.

WOUNDS INDIRECTLY FATAL. TETANUS FOLLOWING WOUNDS — LATENT CAUSES OF — DEATH FROM SURGICAL OPERATIONS — PRIMARY AND SECONDARY CAUSES OF DEATH — UNSKILFULNESS IN OPERATIONS — NECESSITY FOR THE OPERATION — ERYSIPELAS FOLLOWING OPERATIONS — DELIRIUM TREMENS.

Tetanus following wounds.—Tetanus frequently presents itself as a secondary fatal consequence of wounds,—especially of those which are lacerated or contused, and affect nervous or tendinous structures. It has often occurred as a result of very slight bruises or lacerations, when the injury was so superficial as to excite no alarm; and it is a disease which gives no warning of its appearance. Dr. Brady met with a case in which a man slipped in walking, and fell flat on his back. He was stunned. but able to walk home. He apparently recovered from this simple accident, but on the following day he was attacked with tetanus and died in seventy hours. (Lancet. May 15. 1847, p. 516.) In *Reg.* v. *Butcher* (Warwick Lent Assizes, 1848), it was proved by the medical evidence that the deceased had received a blow on the nose which caused severe bleeding. In spite of good surgical treatment, the man was attacked with tetanus on the fifteenth day, under which he sank. On inspection, it was found that one of the small bones of the nose had been broken, and this had given rise to the fatal attack. Tetanus may come on apparently from spontaneous causes. *i. e.* independently of the existence of any wound on the body. In this form it is called idiopathic, to distinguish it from the tetanus of wounds, which is called traumatic. Many cases have been brought into the London hospitals, in which the only cause of this disease appeared to be exposure to cold or wet.—or in some instances, exposure to a current of air. (Lancet, Dec. 14. 1844. p. 351) Dr. Watson met with a case in which tetanus appeared in a severe form in a man who had received no wound. but who had been simply exposed to cold or wet. (Cormack's Monthly Journal, Dec. 1845, p. 902.) It is scarcely possible to distinguish, by the symptoms, tetanus from wounds from that which occurs spontaneously as a result of natural causes. In endeavouring to connect its appearance with a particular wound or personal injury, it will be proper to observe — 1. whether there were any symptoms indicative of it before the maltreatment; 2, whether any probable cause could have intervened to produce it between the time of its appearance and the time at which the violence was inflicted; 3. whether the deceased ever rallied from the effects of the violence. The time at which tetanus usually makes its appearance, when it is the result of a wound, is from about the third to the sixth day; but it may not appear until three or four weeks after the injury, and the exciting cause may still be traced to the wound which has healed. When resulting from a wound it is generally fatal.

A medical practitioner is bound to exercise great caution before he pronounces an opinion that a fatal attack of tetanus has arisen either from spontaneous causes or from slight blows or personal injuries. A case occurred in St. Bartholomew's Hospital, in September, 1853, which exemplifies the necessity of making a rigorous inquiry into all the attendant circumstances. A boy, æt. 15, while quarrelling with another, received a blow in the back from his companion's fist, and this was followed by a kick, but not of a severe character. He was able to get up and walk home; in about two hours he complained of stiffness about the jaw. He passed a restless night,—the stiffness increased; there was great pain, and subsequently difficulty of swallowing. On the second day he was admitted into the hospital,—the pain and stiffness gradually increased, and the jaw became partially fixed. Spasm of the muscles of the back supervened, occurring in paroxysms, and there was confirmed tetanus. He died on the fourth day after he had received the blow on the back, and apparently from tetanus as a result of that violence: it turned out, however, on inquiry, that six days previously to the first appearance of the tetanic symptoms, the boy had accidentally driven a rusty nail into his foot, and that the suppurating wound which resulted from this injury had only closed on the day on which the blow was inflicted. On an examination of the body a small puckered cicatrix, such as would result from the healing of a punctured wound, was found on the ball of the great toe, and there could be no doubt from the circumstances, that this, and not the slight blows struck by the assailant, had been the cause of the fatal attack of tetanus. (See Lancet, Dec. 10, 1853, p. 550.) This case has an important bearing on the question considered at p. 310. It is probable that many cases have been set down as idiopathic tetanus in which, by proper inquiry, the disease might have been traced to a wound or some personal injury. In one instance the tetanus was at first considered to be idiopathic: but shortly before death a small black mark was observed on the thumb-nail. On making inquiry, it was found that a few days previously to the attack a splinter of wood had accidentally penetrated the thumb. The patient attached so little importance to the accident that he did not mention the circumstance to his medical attendant. This was no doubt the cause of the disease.

Death from surgical operations.—In the treatment of wounds, surgical operations are occasionally resorted to, and a wounded person may die either during the performance of an operation, or from its after-consequences. A question may thence arise, whether the person who inflicted the wound shall be held responsible for the fatal result. The law regards a surgical operation as part of the treatment, and if undertaken *boná fide*, and performed with reasonable care and skill, the aggressor will be held responsible, whatever may be the result. The necessity of the operation, and the mode of performing it, will be left to the operator's judgment. As the defence may turn upon the operation having been performed unnecessarily, and in a bungling and unskilful manner, it will be right for a practitioner, if possible, to defer it until he has had the advice and assistance of other practitioners. According to Lord Hale, if death takes place from an *unskilful operation*, performed for the cure of a wound, and not from the wound, the responsibility of the prisoner ceases; but this eminent lawyer does not appear to have considered that death may take place as a consequence of the most skilful operation required for the treatment of a wound, and yet be wholly independent of the wound itself.

Should an operation be unnecessarily or unskilfully performed, the responsibility of an aggressor would, it is presumed, cease, if the death of a wounded party could be clearly ascribed to it. Thus, if in carelessly bleeding a wounded person, the brachial artery should be laid open (Ann. d'Hyg., 1834, t. 2, p. 445), or if, in performing amputation, a large artery be improperly secured, so that the patient in either case dies from loss of blood, the prisoner could not be equitably held responsible; because it would be punishing him for an event depending on the unskilfulness of a medical practitioner. According to Platt, B. (p. 331), a prisoner will be held responsible, if the original wound were likely to produce death, although unskilfully treated. Supposing the bleeding or amputation to be performed with ordinary care and skill,—and yet, in the one case inflammation of the veins, and in the other tetanus, gangrene, or fever, should destroy life, the prisoner will be liable for the consequences. The practice of the law is strictly consistent with justice. Should the operation be considered to be *absolutely* required for the treatment of a wound, which, according to all probability, would prove mortal without it,—should it be performed with ordinary skill, and still death ensue as a direct or indirect consequence, it is only just that the person who inflicted the injury should be held responsible for the result. It is presumed in these cases, that were the patient left to himself, he would, in all probability, die from the effects of the wound. If, therefore, a surgeon, knowing that an operation would give a chance of saving life on such an occasion, did not perform it, it might be contended in the defence, that the deceased had died, not from the wound, but from the incompetency and neglect of his medical attendant. Hence it follows, that if, during this necessary treatment, unforeseen though not unusual causes cut short life, no exculpation should be admitted, if it went to attack the best-directed efforts made for the preservation of life. (See Ann. d'Hyg. 1835, t. 1. p. 231.)

When a wounded person is taken to an hospital in which gangrene or erysipelas is diffusing itself by infectious propagation, and he is attacked by one of these diseases before or after the performance of an operation, and dies—a prisoner may be held responsible for the fatal result. It might be contended, that the transportation of the wounded man to such a locality was not absolutely necessary to the preservation of his life, and that he would not then have died, but for the accidental presence of an infectious disease. Cases of this kind cannot be easily decided by general rules: but the question has already been raised before a legal tribunal, in a trial which took place at the Maidstone Lent Assizes, 1839. (*The Queen* against *Connel and others.*) The deceased was assaulted by a number of soldiers, and received two blows on the head with a stick. The wound was not of any great extent, and the deceased did not appear to suffer much from it. Two days afterwards, he was attacked by *erysipelas* in the head and face, and be died in about a week. On inspection, there was no appearance of disease. The surgeon referred death to erysipelas, which was prevalent in the hospital at the time the deceased was brought in. The man would probably have recovered but for the attack of erysipelas, and he did not think that he would have been attacked by that disease but for the wound. Erysipelas was an infectious disease, and a common consequence of wounds of the head. Upon this evidence the prisoners were convicted. In *Reg.* v. *Norris*, (Wells Summer Assizes, 1860,) the deceased, a gamekeeper, died from tetanus following amputation of the leg, rendered necessary by a gun-shot wound inflicted by the prisoner. No attempt was made to deny the responsibility of the prisoner for the fatal result.

Questions relative to responsibility in death following operations would come more frequently before Courts of law, were it not that the cases are stopped in the Coroners' courts by verdicts of accidental death. (See Med. Gaz. vol. 19. p. 157.) It unfortunately happens that on these occasions there is great difference of opinion among medical witnesses respecting the connection of the disease with the death, and, indeed, the necessity for the operation itself. The evidence of opinion in favour of the prosecution is sometimes exactly balanced by that urged in the defence: and under these circumstances, the only course open to the Court, is to discharge the accused. Differences of opinion upon these subjects among members of the profession tend to convey to the public the impression that there are no fixed principles upon which medical opinions are based; and, consequently, that it would be dangerous to act upon them. Thus it is that we are accustomed to hear of a medical prosecution and a medical defence, as if the whole duty of a medical jurist consisted in his making the best of a case, on the side for which he happens to be engaged,—adopting the legal rule for suppressing those points which are against him, and giving an undue prominence to others which may be in his favour. This is an unfortunate condition of things, for which at present there appears to be no other remedy than that of appointing a Medical Board of competent persons to whom such questions might be referred, in the same manner as questions relative to navigation are referred by the Admiralty Court to a Board formed of members of the Trinity House,—professionally acquainted with the matters in dispute.

CHAPTER 32.

CICATRIZATION OF WOUNDS—EVIDENCE FROM CICATRICES—CHANGES IN AN INCISED WOUND—CICATRICES OF STABS AND GUN-SHOT WOUNDS—DATE OF PRODUCTION—IS A CICATRIX ALWAYS A CONSEQUENCE OF A WOUND?—ARE CICATRICES, WHEN ONCE FORMED, INDELIBLE?—CHARACTERS OF CICATRICES—DATE OF CICATRICES FROM DISEASE OR WOUNDS—MEDICAL EVIDENCE RESPECTING THE PERIOD AT WHICH A WOUND WAS INFLICTED—CHANGES OF COLOUR IN CONTUSIONS—HOW LONG DID THE DECEASED SURVIVE THE WOUND?

Cicatrization of wounds.—The period of time at which a particular wound was inflicted, may become a medico-legal question, both in relation to the living and dead. The identity of a person, and the correctness of a statement made by an accused party, may be sometimes determined by an examination of a wound or its cicatrix. So, if a dead body be found with marks of violence upon it, and evidence adduced that the deceased was maltreated at some particular period before his death, it will be necessary for a practitioner to state whether, from the appearance of the injuries, they could or could not have been inflicted at or about the time indicated. A case was tried at the Taunton Spring Assizes, 1841 (*The Queen* against *Raymen*), wherein evidence of this kind served to disprove the statement made by the accused. He was charged with maliciously cutting and wounding the prosecutrix. There was a cut upon his thumb, which he accounted for by saying it was from an accident that had occurred three weeks before. The medical witness declared, on examining it, that it could not have been inflicted more than two or three days, which brought the period of its infliction to about the time of the murderous assault. This and other circumstances led to his conviction.

An *incised* wound inflicted on the living body, gradually heals by adhesion when no circumstances interfere to prevent the union of the edges. For eight or ten hours the edges remain bloody,—they then begin to swell, showing the access of inflammation. If the parts are not kept well in contact, a secretion of a serous liquid is poured out for about thirty-six or forty-eight hours. On the third day this secretion acquires a purulent character. On the fourth and fifth days, suppuration is fully established, and it lasts five, six, or eight days. A fibrous layer, which is at first soft and easily broken down, then makes its appearance between the edges :—this causes them gradually to unite, and thus is produced what is termed a *cicatrix*. Cicatrization is complete about the twelfth or fifteenth day, when the wound is simple, of little depth, and only affecting parts endowed with great vitality. The length of time required for these changes to ensue will depend —1. On the situation of the wound ; — wounds on the lower extremities are longer in healing than those on the upper part of the body. If a wound be situated near a joint, so that the edges are continually separated by the motion of the parts, cicatrization is retarded. 2. On the extent. Wounds involving many and different structures are longer in healing than those simply affecting skin and muscles. 3. On the age and health of the wounded party ;— the process of cicatrization is slow in those who are diseased and infirm. In an incised wound, the cicatrix is generally straight and regular ; but it is semilunar if the cut be oblique. It is soft, red, and tender if cicatrization be recent : it is hard, white, and firm if of long standing. On compressing the skin around an old cicatrix, its situation and form are well marked by the blood not readily entering into it on removing the pressure. It has been said that the cicatrices of incised wounds are rectilinear, but this is not always the case ; in general, they are more or less elliptical, being wider in the centre than at the two ends,—this appears to be due principally to the elasticity of the skin and the convexity of the subjacent parts ; thus it is well known that in every wound on the living body the edges are much separated in the centre, and this physical condition influences the process of cicatrization. When the wound is in a hollow surface, or over a part where the skin is not stretched, as in the armpit or groin, then the cicatrix may be rectilinear, or of equal width throughout. If there were any loss of substance in an incised wound, or if the wound were lacerated or contused, the cicatrix would be irregular, and the healing would proceed by granulation. The process might then occupy five, six, or eight weeks, according to circumstances. When healed, the cicatrix would be white, and if there had been a loss of substance it would have a puckered appearance; the surface of the skin would be uneven. (See an essay on this subject by Dr. Krugelstein, Henke's Zeitschrift der S. A. 1844, b. 2. s. 75.)

Is a cicatrix always a consequence of a wound?—If we here use the term wound as implying a breach of continuity affecting the layers of the true skin, a cicatrix is always produced in the process of healing. In even cuts made by a very sharp instrument, especially if they are in the direction of the fibres of subjacent muscles, and the parts are kept in close apposition, the cicatrices are even, linear, and sometimes so small as to be scarcely perceptible. If the skin is white, they may be easily overlooked. Wounds of this kind are not, however, commonly the subject of medico-legal inquiry. If, on examining a part, where at some previous time a stab or a cut is alleged to have been inflicted, we find no mark or cicatrix, it is fair to assume that the allegation is false, and that no wound has been inflicted, making due allowance for the fact that mere abrasions of the cuticle, or very slight punctures and incisions, often heal without leaving any well-marked cicatrices.

Is a cicatrix, when once formed, ever removed or so altered by time as to be no longer recognisable?—This is a question, which sometimes presents itself to a medical jurist both in civil and criminal proceedings. They who have given close attention to the subject, agree in considering that cicatrices, when they are once so produced in the cutis as to be easily perceptible, are indelible:— they undergo no sensible alteration in their form or other external characters. The tissue of which a cicatrix is formed, is different from that of the skin: it is harder and less vascular, and is destitute of rete mucosum, so that its whiteness, which is remarkable on the cicatrized skin of a negro, is retained through life. If any cicatrices were easily obliterated, it would be those which are even and regular,— the results of incised wounds by sharp instruments; but I have observed that cicatrices of this kind have certainly retained their characters unchanged in one instance for twenty, and in another for twenty-five years. According to the observations of Dupuytren and Delpech, the substance of a cicatrix is not converted into true skin—it never acquires a rete mucosum. In the cicatrices of lacerated and contused wounds, the form of the weapon with which the wound was inflicted is sometimes indicated. It is not, however, easy to distinguish the cicatrix of a stab from that produced by a pistol-bullet fired from a distance. In both cases the edges may be rounded and irregular, and the cicatrix puckered, unless the stab has been produced by a broad-bladed weapon.

Characters of cicatrices.—It is important to observe that all cicatrices are of smaller size than the original wound: for there is a contraction of the skin during the process of healing. This is especially observed with regard to the cicatrix of a *stab*, which is frequently of a triangular form. A recent wound as it has been elsewhere stated, is apparently smaller than the weapon; and the resulting cicatrix is always smaller than the wound. Hence it is difficult to judge of the size of the weapon from an examination of the cicatrix. In gun-shot wounds, if the projectile has been fired from a distance, the cicatrix is of smaller diameter than the ball:—it represents a disk depressed in the centre, and attached to the parts beneath; while the skin is in a state of tension from the centre to the circumference. If the bullet has been fired near to the body, the cicatrix is large, deep, and very irregular. If the projectile has made two apertures, the aperture of exit is known by the greater size and irregularity of the cicatrix. (See Ed. Monthly Journal, 1854, vol. 10. p. 370.) As the age of a cicatrix increases, it becomes smaller, thicker, more shining, fainter in colour and less sensitive.

Cicatrices from disease or wounds.—In certain cases a question may arise whether the cicatrix on a person has resulted from a wound or from loss of substance through disease, *e. g.* scrofulous ulceration. In the case of *Smyth* v. *Smyth* (Gloucester Summer Assizes, 1853), the plaintiff claimed to be the rightful heir to certain estates occupied by the defendants. He based his claim upon some deeds (alleged by the defendants to have been forged), in which it was stated, that the lost heir to these estates would be known by certain marks on his right hand and wrist, suggested to have been received at the time of his birth, in 1797, by reason of his having been brought into the world by instruments. It was one of the curious features of this extraordinary case of imposture, that no medical opinion was taken or required by the claimant on the probable nature and origin of these marks. When requested at the trial to show his hand to the jury, the mark had the appearance of a puckered cicatrix from a scrofulous ulcer near the wrist. Similar marks from scrofulous sores were seen upon his neck. His statements regarding himself, and the circumstances on which he based his claim, were so improbable and contradictory, that the case speedily broke down. A question of this kind may occasionally present some difficulty, but a close examination of the cicatrix, with a consideration of the statement of the person as to its mode of production, will generally enable a practitioner to arrive at a satisfactory conclusion respecting its origin. *Scrofulous* ulcers are generally observed to leave irregular and furrowed cicatrices, with smooth depressions, surrounded by hard and uneven margins. According to Schneider, the *scorbutic* cicatrix is dark, bluish-red in colour, soft to the touch, somewhat raised and rather painful: in the course of time it becomes flatter, of a reddish-brown colour, approaching to green (?) in the centre, and very thin and easily injured. *Syphilitic* cicatrices are characterised by great loss of substance: they approximate the margins of the deep ulcers before their granulations have had time to reach the surface. *Glandular* cicatrices are irregularly tumified, generally deep, hardened, and of a reddish-brown colour. These varieties cannot easily be mistaken for the cicatrices of wounds.

When was the wound inflicted?—When an individual is not seen until after death, and there are recent wounds on his body, a medical jurist may be required to state at what period they were probably inflicted. It may be taken as a general rule that there are no appreciable changes in any wound until eight, ten, or twelve hours have elapsed from the time of its infliction; then we have the various phenomena of inflammation, followed by adhesion, suppuration, or gangrene, during any of which stages the wounded person may die. Some remarks have already been made on the time at which adhesion and suppuration are established in wounds; and with respect to gangrene it may be observed, that the deceased must have survived at least fifty hours, in order that this process should be set up: in old persons it may take place earlier.

In examining a dead body, we must take care not to confound the effects of putrefaction in a wound with those of gangrene. Putrefaction always commences sooner in parts which are wounded than in those which are uninjured; but the general appearance of a body will show whether the changes in the wound are or are not due to putrefaction. The collapse of the eye will indicate the existence of this process; but the presence of warmth or rigidity of the members will show that death may have been too recent for putrefaction to have become established. The time at which a severe *contusion* has been produced, may be commonly determined by noting the changes of colour which take place around it. It is rarely until after the lapse of twenty-four or thirty-six hours that these changes of colour appear. (See Ecchymosis, *ante*, p. 240.) The livid circumference passes into a green circle, which is gradually diffused into a wide straw-yellow band, bounding the ecchymosis on every side, if it be in a free or loose part of the skin. In four, five, or six days, the dark livid colour slowly disappears from the circumference to the centre, while the coloured bands spread more widely around. A central dark spot may be perceived after ten days or a fortnight, and in an extensive ecchymosis it is some weeks before all traces of colour are lost. The rapidity of these changes will be modified by circumstances elsewhere stated. Observations of this kind often lead to useful results when proper caution has been taken. The appearances presented by a contusion inflicted recently before death, and of another inflicted some days before, are of course different; and by an appreciation of this difference, a person charged with murder may or may not be connected with one or the other period of infliction, or with both. In a case of alleged manslaughter, in which I was consulted some years since, there were found on the person of the deceased, the wife of a mechanic, the marks of severe bruises; some of them, in the immediate neighbourhood of each other, had the rings of colour peculiar to a disappearing ecchymosis, while others had not. The man alleged in his defence that he had only struck his wife once, a few hours before her death, whereas the above medical facts proved not only that the deceased had been struck more than once, but that some of the blows must have been inflicted probably several days before her death. These inferences were corroborated by the evidence of an apprentice who had witnessed the assaults.

Such is an outline of the facts which may occasionally enable us to say how long before death particular injuries have been received; or to assign a probable period for their infliction on the living. By their aid we may have it in our power to determine whether two wounds found on a dead body were or were not inflicted at or about the same time. The law in these cases seldom requires a precise medical opinion; indeed it would be scarcely possible to give this under any circumstances. If a medical witness can only state *about* what time the injury was inflicted, circumstantial evidence will make up for the want of great medical precision or accuracy on the point.

How long did the deceased survive?—This question, it will be perceived, is indirectly connected with the preceding, although sometimes put with an entirely different object. Supposing the wound not to have been such as to prove rapidly fatal, the length of time which a person has survived its infliction may be determined by noting whether it has undergone any changes towards healing, and in what degree. As a wound remains in the same state for about eight or ten hours after its production, it is not possible to say within this period how long the person may have survived. Then it has been supposed that a medical opinion might be formed from the nature of the injury, and the parts which it has involved. Thus, a wound may have involved large blood-vessels, or organs important to life: in this case it is pretty certain that the individual must have died speedily. Let us, however, bear in mind that these so-pronounced rapidly mortal wounds sometimes do not prove fatal until after the lapse of some hours or days — a fact which has been much overlooked by surgeons, although of considerable importance in relation to the medical jurisprudence of wounds.

CHAPTER 33.

ACTS INDICATIVE OF VOLITION AND LOCOMOTION — INJURIES TO THE HEAD NOT IMMEDIATELY FATAL — WOUNDS OF THE HEART NOT IMMEDIATELY FATAL — WOUNDS OF THE CAROTID ARTERIES — LOCOMOTION AFTER RUPTURES OF THE DIAPHRAGM AND BLADDER — SUMMARY.

Acts indicative of volition and locomotion. — In cases of death from wounds criminally inflicted, it is often a matter of serious inquiry, whether a person could have performed certain actions, or have moved after receiving an injury which is commonly regarded as necessarily mortal, and likely to destroy life speedily. In respect to wounds of a less grave description, if we except those affecting the members directly, which will be hereafter examined, the power of willing and moving in the person who has received them cannot be disputed. The best method of treating this subject will be perhaps, to select a few cases of severe injuries to important parts or organs, which are usually considered to destroy life speedily. The question relative to the power of exercising volition and locomotion, has been chiefly confined to those cases in which there were injuries to the head, wounds of the heart, the large blood-vessels, the diaphragm, and bladder.

Injuries to the head not immediately fatal. — The following case occurred a few years since in the Norfolk and Norwich Hospital:—A boy, owing to the bursting of a gun, had the breech-pin lodged in his forehead. He got out of the cart, in which he had been brought four or five miles, and walked into the hospital without assistance. The pin was firmly impacted in the frontal bone, about the situation of the longitudinal sinus. On its removal, a portion of brain came away with several pieces of bone, and the aperture in the cranium was nearly an inch in diameter. Symptoms of coma then came on, and the boy died in forty-eight hours. The brain was found to be considerably injured. (Med. Gaz. vol. 18. p. 458.) Mr. Watson mentions a similar case. During a quarrel between father and son, the latter threw a poker at the former with such violence that the head of the poker stuck fast in his forehead, and was with some difficulty withdrawn. The father asked those who were near him to withdraw the weapon, and he was afterwards able to walk to the infirmary. He died from inflammation of the brain. (On Homicide, p. 62.) A case occurred to Dr. Wallace, of Dublin, in which a man fell from a scaffold on the summit of his head. He was stunned by the fall, but on reaching the hospital, dismounted from the car which conveyed him, and walked upstairs with very little assistance. He died in three days, but he remained perfectly rational, and was enabled to get up and go to the water-closet the day before his death. On inspection, there was only a slight abrasion on the summit of the head, but the skull was found split into two nearly equal halves from the frontal bone backwards, and the longitudinal sinus was laid open throughout. In the hemispheres of the brain there was a large quantity of effused blood in a semi-coagulated state; and more than two ounces were found at the base of the skull. (Lancet, April 1836.) Supposing this person to have been found dead with such extensive injuries, the medical opinion would probably have been that he was not likely to have lived or moved afterwards; and yet the power of volition and locomotion remained with him for two entire days!

It is easy to conceive many cases in which a question of this kind will be of material importance. For instance, a man may fall from a height, and produce a severe compound fracture of the skull. He may, nevertheless, be able to rise and walk some distance before he falls dead. (See case, *ante*, pp. 248, 259.) Under these circumstances there might be a strong disposition to assert that the deceased must have been murdered,—the injuries being such that they could not have been produced by himself, there being at the same time no weapon near, and no elevated spot from which he could have fallen. The discovery, after death, of severe injury to the head, with great effusion of blood on the brain, must not lead a surgeon to suppose that the person who sustained the violence had been immediately incapacitated. In *Reg.* v. *Milner and others* (Derby Summer Assizes, 1854), in which a Mr. Bagshawe had been assaulted by the prisoners and had died from the injuries sustained, it was proved that the temporal bone was beaten in, the base of the skull fractured, and there was a large coagulum of blood effused on the left side of the brain, which by its pressure had flattened this organ. Notwithstanding these injuries, deceased walked a considerable distance, and he survived about twelve hours. There is reason to believe that in this and other cases of a similar kind the large effusion of blood was an after-result.

Wounds of the heart not immediately fatal.—Wounds of the heart were formerly considered to be immediately fatal to life: but this only applies to those wounds by which the cavities of the organ are extensively laid open. Persons who have sustained wounds of the heart have frequently lived sufficiently long to exercise the power of volition and locomotion. Mr. Watson met with a case in which a man who had been stabbed in the right ventricle ran eighteen yards after having received the wound. He then fell, but was not again able to rise; he died in six hours. On dissection, it was found that a punctured wound had extended into the right ventricle in an obliquely transverse direction, dividing in its course the coronary artery. The pericardium was nearly filled with blood, and about four pounds were effused on the left side of the chest. (On Homicide, p. 98.) One of the most remarkable cases of the preservation of volition and locomotion after a severe wound of the heart will be found reported in the Medical Gazette (vol. 14. p. 334). In this case the patient, a boy, survived five weeks, and employed himself during that period in various occupations. After death a mass of wood was found lodged in the substance of the heart. Had this boy been found dead with such an injury, it is most probable the opinion would have been that his death was instantaneous. Dr. Darling, of New York, has communicated to me the particulars of a case which occurred in February 1855, in which a man survived for a period of *eleven days* a bullet-wound of the heart. Soon after receiving the wound he became senseless, cold, and pulseless, and remained in this collapsed state for four hours. He then rallied, but died on the eleventh day. On inspection, there was no effusion of blood: the pericardium was much distended by serum, the result of inflammation. A bullet, one-third of an inch in diameter, was found lodged in the septum or fleshy partition between the right and left ventricles, about midway between the apex of the heart and base of the ventricles. There was no communication with the cavities—the wound had entirely cicatrized; and inflammation of the pericardium was obviously the cause of death.

A case of some interest in reference to the power of surviving a severe wound of the cavities of the heart, occurred at Guy's Hospital, in February 1854, for the particulars of which I am indebted to Mr. Callaway. An Italian, æt. 38, discharged a brace of pistols into his chest on the left side. The man was brought to the hospital, was able to converse on his condition, and lived one hour and fifteen minutes after the infliction of the wound. After death it was found that one bullet had perforated the pericardium, entered the right ventricle, and, after traversing the septum of the ventricles, made its exit from the heart at the junction of the left auricle with the ventricle. It traversed the upper lobe of the left lung, and was found fixed in one of the dorsal vertebræ. The second bullet perforated the left ventricle, and then traversed the left lung. This wound was of such a nature, that at every contraction of the ventricle, the opening must have been closed so as to arrest the flow of blood. This man, owing to severe suffering, rolled about the floor, and was with difficulty kept quiet. It will be seen that in this case there were bullet-wounds traversing completely the cavities of the heart; yet the man could talk and exert himself, and he actually survived their infliction *one hour and a quarter*. Had the body been found dead in a suspicious locality, the discovery of such wounds in the ventricles of the heart might probably have led to a medical opinion that the death of the man must have been instantaneous! In these cases, little or no blood probably escapes from the heart in the first instance, but it may afterwards continue to ooze gently, or suddenly burst out in fatal quantity. It must not, therefore, be supposed, when a person is found dead with a wound of the heart, attended with abundant hæmorrhage, either that the flow of blood took place in an instant, or that the person died immediately and was utterly incapable of exercising any voluntary power. Only one condition will justify a supposition of this kind,—namely, when the cavities of the organ, especially the auricles, are largely laid open.

Wounds of the carotid arteries not immediately fatal.—Questions relative to the power of locomotion perhaps more frequently occur with respect to wounds of the great blood-vessels of the neck than of the heart,—suicide and murder being more commonly perpetrated by the infliction of such wounds. There are several cases on record which show that wounds involving the common carotid artery and its branches, as well as the internal jugular vein, do not prevent a person from exercising voluntary power, and running a certain distance. In one of these (*Rex* v. *Danks*, Warwick Lent Assizes, 1832) it was proved that the deceased had died from a wound in the throat inflicted by the prisoner, which divided the trunk of the carotid artery, the principal branches of the external carotid and the jugular veins. The evidence rendered it probable, if not certain, that after the infliction of this wound, the deceased had been able to run twenty-three yards and to climb over a gate,—the time required for the performance of such acts being at least from fifteen to twenty seconds. Most medical witnesses would have probably given an opinion that the deceased could not have moved from the spot where such a wound had been inflicted; but it was clear that she had gone this distance—there was no dragging of the body, and no motive for its being dragged by the prisoner and exposed in an open road, where it was found. (Medical Gazette, vol. 10. p. 183.) Such cases as these show the necessity of caution in giving an opinion respecting immediate death from wounds.

There is one circumstance which requires notice in relation to severe wounds in the *throat*—namely, that although the individual may have the power of locomotion, he may not be able to use his voice so as to call for assistance. It sometimes excites surprise at an inquest, how a murder may in this way be committed without persons in an adjoining room hearing any noise; but the fact is well known medically, that when the windpipe is divided, as it generally is on these occasions, the voice is lost.

Ruptures of the diaphragm.—A rupture of the *diaphragm* has been considered sufficient to deprive a person of the power of locomotion; but there appears to be no good ground for this opinion. The general effect of such an injury may be to incapacitate a person; but still there may a power of moving and walking after a rupture of this muscle.

Ruptures of the liver, unless attended at once with great loss of blood, do not prevent a person from exercising his muscular power. In the case of *Gordon* (Glasgow Spring Circuit, 1856), it was proved that the deceased had died from ruptured liver; but after sustaining the violence, he had been able to reach home on foot, although with some difficulty.

Ruptures of the bladder.—In ruptures of the *bladder*, attended with extravasation of urine, a question has arisen respecting the power of locomotion. The following cases will show that this power does exist in some instances, although the general result is perhaps to incapacitate the individual from moving:—A man, aged thirty-one, while intoxicated, received a blow on the lower part of his abdomen. He was sobered by the accident, and walked home, a distance of a quarter of a mile, although suffering severe pain. When seen in the evening, twelve ounces of bloody urine were drawn off by a catheter, and he complained of having felt cold immediately after he had received the blow. He died four days after the accident. On inspection, there was no mark of bruise or ecchymosis on any part of the abdomen. The bladder was ruptured in its upper and posterior portion for about an inch. (Lancet, May 14, 1842.) The second case was related to me by a pupil. A gentleman who had been compelled to retain his urine, fell accidentally, in descending a staircase, with the lower part of his abdomen against the edge of one of the steps. The sense of fulness in his bladder immediately ceased, and he walked to a friend's house to dinner. The nature of the accident was mentioned to a surgeon there present, who immediately suspected that the bladder must have been ruptured. The case terminated fatally in twenty-four hours. A case is reported by Mr. Hird, in which a man walked a distance of two miles after having sustained a rupture of the bladder; and in another which occurred in January, 1852, communicated to me by Mr. Rake, the man, who sustained the injury in a scuffle, was able to walk a mile between two and three hours after the occurrence. (See also Lancet, Oct. 31, 1846, p. 480.) Thus, then, from these various instances, it is evident that locomotion and muscular exertion may take place after an accident of this description.

Summary.—Under survivorship from many severe accidents or personal injuries, this power of moving, if not exerted to a large extent, may take place in a small degree: and this may become occasionally an important question in legal medicine.

Thus it must not be lost sight of, when we are drawing inferences as to the relative position of an assailant and a murdered person from the situation in which the body of the deceased is found. A dead man, with a mortal injury to the head or heart, may be found lying on his face, when he actually fell upon his back, but still had had sufficient power to turn over before death; or he may have fallen on his face, and have afterwards moved, so that the body may be found lying on the back. A slight motion of this kind is very easily executed; it does not always depend on volition. Individuals suffering from severe concussion have been frequently known to perform acts unconsciously and automatically. The cases above related may perhaps be considered rare, and as exceptions to the general rule. The medical jurist must bear in mind, however, that he is not required to state in how many, out of a given number of persons similarly wounded, this power of performing acts indicative of volition and locomotion may remain, but simply whether the performance of these acts is or is not *possible*. It is on this point only that the law requires information. The hypothesis of guilt, when we are compelled to judge from circumstances in an unknown case, can only be received on the exclusion of every other possible explanation of the facts. On surgical prognosis or treatment, such cases, from their rare occurrence, may have little influence; but in legal medicine the question is widely different. Medical facts, however rare, here admit of a very important and unexpected application.

Struggling after severe wounds.—Although, in cases of severe wounds, we may allow that persons may survive for a sufficiently long period to perform various acts of volition and locomotion, yet the presence of a mortal wound, especially when of a nature to be accompanied by a great loss of blood, must prevent all *struggling* or violent exertion on the part of the wounded person; such exertion we must consider to be quite incompatible with the condition of the wounded person. A medical jurist may thus have it in his power to determine whether a mortal wound found on the deceased has been inflicted for the purpose of murder or in self-defence, as the following case, reported by Mr. Watson, will show:— A man was tried at the Lancaster Assizes in 1834, for the murder of a woman at Liverpool, by stabbing her in the chest. Prisoner and the deceased, with two other females, were quarrelling in the passage of a house. A struggle ensued between the prisoner and deceased, which one of the witnesses said lasted for *ten minutes*. When the prisoner had reached the door, he pulled out a knife and stabbed the deceased in the chest. She fell, and died almost immediately. The prisoner alleged that he was attacked by several persons, and that he stabbed the woman in self-defence. The judge said, if the blow had been struck with premeditation before the struggle, the crime would be murder, — if during the struggle, it would be manslaughter. The medical evidence showed that the blow could not have been struck before the struggle, because it was of a speedily mortal nature; and the deceased would not then have been able, as it was deposed to by the witnesses, to struggle and exert her strength with the prisoner for *ten minutes* afterwards. This being the case, it followed that in all medical probability the deceased had received the wound towards the conclusion of the quarrel; and therefore it might have been inflicted while the prisoner was attempting to defend himself. The jury returned a verdict of manslaughter.

A case involving this medico-legal question was tried at the Gloucester Lent Assizes, 1849 (*Reg.* v. *Hobbs*). The prisoner was indicted for the wilful murder of a man with whom he had been drinking and quarrelling. It appears that in the early part of the quarrel the deceased threw the prisoner down and struck him unfairly. The deceased was told by the landlord of the inn to go home. He replied "Very well," and then leaving the prisoner, went through the entrance-arch of the inn up the yard, which was his usual way of going home. About *seven minutes* afterwards the prisoner, who had complained to the landlord of the maltreatment which he had undergone, returned into the inn-yard, and was seen on entering it to pull down his waistcoat and button his coat. A witness advised him to go home, and he left the spot. A short time afterwards the deceased was found at the back of the yard, lying on his face and quite dead. On examining the body it was ascertained that the deceased had been stabbed in two places, one of the stabs having penetrated the ventricle of the heart. On apprehending the prisoner, a large clasp knife was found in his pocket stained with blood. The prisoner admitted that he had stabbed the deceased, but said it was *during the quarrel*, and that he had used the knife in self-defence while they had him on the ground. This was the defence. For the prosecution it was contended that the deceased had been stabbed by the prisoner subsequently to the quarrel — that he had gone through the gate into the yard to meet the deceased, had there stabbed him, and had caused his instant death. The medical witness who was called, stated at first, that from such a wound death must have been *instantaneous*. In cross-examination, however, he admitted that the deceased might have lived some time after he had been stabbed: and on this evidence the prisoner was convicted of manslaughter, and sentenced to six months' imprisonment.

The medical facts of this case are rather imperfectly reported: hence it is difficult to give a decided opinion respecting the time at which the deceased was stabbed in the heart. It is true that the Duc de Berri survived a punctured wound of one of the ventricles for the long period of eight hours; but every case must be judged by the special circumstances accompanying it. The size of the stab in the ventricle is not stated; nor is it in evidence whether any blood was found on the spot where the deceased was struggling with the prisoner. That the deceased should have struggled with the prisoner for one minute after he had been stabbed in the ventricle of the heart is contrary to all medical experience and probability. It is also irreconcilable with the existence of such a wound, that the deceased should have spoken to the landlord, — that he should not have called the attention of the latter to the fact of his having been stabbed by the prisoner while struggling with him, — that he should have been stabbed in the heart without knowing it, or without being aware of his condition,—that he should have been able thereafter to walk away through the inn-yard to the house, and survive seven minutes while thus walking; and yet all these circumstances must have happened, in order that the defence, and the verdict based upon it, should be true. Taking the facts as reported, it appears to me that it is impossible to arrive at any other conclusion than that the deceased was stabbed by the prisoner subsequently to the quarrel, while he was walking through the inn-yard. The only circumstances for the defence were the prisoner's statement, and that, in some rare cases, certain wounds of the heart do not prove immediately fatal.

The case of *Reg.* v *E. M. Brown* (Dorchester Summer Assizes, 1856) presents some points of interest in reference to the question under consideration. The prisoner was charged with the murder of her husband by blows on the head while in her room. Her statement was that the violence on the head was produced by the kick of a horse. The medical evidence showed that the bones of the nose were broken: there was a triangular wound exposing the bone above the left eyebrow, another triangular wound exposing the bone at the top of the head, and a third wound at the back of the head. The left ear was perforated; and behind it was a long wound divided into two. The frontal bone was fractured from the orbit, through the parietal into the occipital bone. Seven pieces of bone, varying in size from half an inch to three inches, had been driven into the brain, and a large quantity of blood was effused. The prisoner's account was that she found her husband thus wounded and bleeding outside the house, that she dragged his body into an inner room, and, further, that though thus wounded, he held her tightly by the clothes for two hours afterward. It was proved that there was no blood over the front of the person or dress of leceased, and that there was no blood in the passage or in any oart of the house, except in the room where the body was found ying. Further, the injuries were not such as a kick from horse would explain; and the medical witness properly stated that a man thus injured could not have held the prisoner by the clothes for two hours, so as to prevent her from seeking earlier for assistance. The facts showed that deceased had been killed by blows where the body was found; and the prisoner was convicted.

CHAPTER 34.

WOUNDS AS THEY AFFECT DIFFERENT PARTS OF THE BODY—WOUNDS OF THE HEAD—OF THE SCALP—CONCUSSION—HOW DISTINGUISHED FROM INTOXICATION—EXTRAVASATION OF BLOOD—SEAT OF—AS A RESULT OF VIOLENCE, DISEASE, OR MENTAL EXCITEMENT — WOUNDS OF THE FACE — OF THE ORBIT—OF THE NOSE—DEFORMITY AS A CONSEQUENCE OF WOUNDS OF THE FACE—INJURIES TO THE SPINE—FRACTURES OF THE VERTEBRÆ—DEATH FROM INJURIES TO THE SPINE AND SPINAL MARROW.

THE *danger* of wounds, and their *influence in causing death*, are the two principal points to which the attention of a medical jurist must be directed.

WOUNDS OF THE HEAD.

Incised wounds, affecting the scalp, rarely produce any serious effects; but this will, of course, depend on their extent. When the wound is contused, and accompanied by much laceration of the skin, it is highly dangerous, in consequence of the tendency which the inflammatory process has to assume an erysipelatous character. The results of these wounds are, however, often such as to set all general rules of prognosis at defiance. Slight punctured wounds of the scalp will sometimes terminate fatally, in consequence of inflammation being set up in the tendinous structures, followed by extensive suppuration beneath, while, on the other hand, a man will recover from a lacerated wound by which the greater part of the skin may have been stripped from the bone. There are two sources of danger in *wounds of the scalp:*—1. The access of erysipelatous inflammation. 2. Inflammation of the occipito-frontalis tendon, followed or not by the process of suppuration. Either of these secondary effects may operate fatally in slight or severe wounds. Neither can be regarded in the light of an unusual consequence of a severe wound of the scalp: but when one or the other follows a slight injury, there is reason to suspect that the patient may have been constitutionally predisposed: and if fatal effects ensue, the influence of the predisposition may be considered a mitigatory circumstance. Bad treatment may likewise lead to a fatal result from a wound not regarded as serious in the first instance; but the question, how far the responsibility of the aggressor would be affected by a circumstance of this nature, has been considered in another place (*ante*, p. 315). Wounds of the head are dangerous in proportion as they affect the brain; and it is rare that a severe contused wound is unaccompanied by some injury to this organ. There is, however, a difficulty which a practitioner has here to contend with—namely, that it is scarcely possible to predict, from the *external* appearance of a wound, the degree of mischief which has been produced internally. These injuries, as it is well known, are very capricious in their after-effects: the slightest contusions may be attended with fatal consequences, while fractures, accompanied by great depression of bone, and an absolute loss of substance of the brain, are sometimes followed by perfect recovery. (Cormack's Jour. Sept. 1845, p. 653; Med. Gaz. vol. 39. p. 40; and Phil. Med. Exam. Nov. 1845, p. 696.) Another difficulty in the way of forming a correct prognosis consists in the fact, that a person may recover from the first effects of an injury, but after a short time he will suddenly die; and on examination of the body, the greater part of the brain will be found destroyed by the suppurative process, although no symptoms of mischief may have manifested themselves until within a few hours of death. For a medico-legal account of injuries to the head, see a paper by M. Toulmouche, Ann. d'Hyg. 1859, vol. 2. p. 395, and 1860, vol. 1. p. 143.

Concussion.—The common effect of a violent blow on the head is to produce concussion or effusion of blood, or both. In concussion, the symptoms come on *at once*, and the patient sometimes dies without any tendency to reaction manifesting itself. Concussion is usually indicated by fainting, insensibility, or sudden death occurring immediately after the operation of external violence. In the most severe form, the person drops at the very moment when struck and dies on the spot. (Chelius's Surgery, vol. 1. p. 408.) In other cases, he may linger in a state of insensibility for several days or weeks and then die. In this state there is generally more or less vomiting. It is important to remember that neither compression nor physical injury to the brain is necessary to render concussion fatal. (Traver's Constitutional Irritation, p. 438; Chelius's Surgery, vol. 1. p. 410.) This may be entirely dependent on shock to the nervous system. After death, no particular morbid change may be discovered in the body, or there may be merely the mark of a slight bruise. In *Reg.* v. *Burgess* (Liverpool Lent Assizes, 1845), the deceased, who was the subject of violence, fell and died on the spot, and there was no lesion externally or internally. The state of insensibility observed in concussion may be sometimes only apparent. Mr. Guthrie relates the following singular case:—A gentleman who had met with an accident on board of a vessel at sea, while lying apparently deprived of sense and motion, heard a discussion between a relative and another person, who supposed he was dying, as to the mode in which they would dispose of his body, and he was conscious of his utter inability to make any movement indicating that he was alive and understood their conversation. Fortunately they resolved to convey him to the port to which the vessel was bound.

Inflammation may follow the primary shock from concussion,—suppuration will take place, and the patient may die after the lapse of some weeks, or even months. (See case Med. Times and Gaz. June 30, 1860, p. 645.) It is important, in a medico-legal point of view, to notice that an individual may move about and occupy himself, while apparently convalescent, for a week or ten days after recovery from the first shock, and then suddenly be seized with fatal symptoms, and die. This apparent recovery leads to the common supposition, that death must have been produced by some intervening cause, and not by the original violence to the head—a point generally urged in the defence of such cases. When the inflammation that follows concussion is of a chronic character, the person may suffer from pain in the head and vomiting, and die after the lapse of weeks, months, or even years. (See Traver, Op. cit., p. 445.) A case is mentioned by Hoffbauer, in which a person died from the effects of concussion of the brain, as the result of an injury received eleven years before. (Ueber die Kopfverletzungen, 1842, p. 57.) Concussion may sometimes take place as a consequence of a violent fall on the feet, in which case the head receives a shock through the medium of the spinal column. The skull may be extensively fractured, and the brain may be even shattered by such a fall. This was the cause of death in the case of the late *Duke of Orleans*. (Med. Gaz. vol. 36. p. 368.)

In *Allen* v. *the Chester Railway Company* (Court of Common Pleas, Feb. 1857), the plaintiff claimed damages for injury caused by a railway collision. The evidence showed that the plaintiff received a blow on the head. There were no *immediate* symptoms; but in two days the plaintiff suffered from lightness of the head and other symptoms, attributed by his medical attendant to *concussion* of the brain, as a result of the accident. Subsequently there were symptoms of injury to the spine. There was pain in the course of the spine, partial paralysis of the bladder, rectum, and lower extremities, with loss of memory. The medical witnesses for the plaintiff, including Mr. Solly and Mr. Wells, attributed these symptoms to a blow received by plaintiff at the base of the skull. The defendants contended that if these were the results of concussion of the brain, they ought to have manifested themselves immediately on the occurrence of the accident; and this view was to some extent supported by the evidence of Mr. Lawrence, Mr. Arnott, Mr. Fergusson, and others. In substance, however, the medical evidence on the two sides was not conflicting. Concussion of the brain, as it is ordinarily known to surgeons, is generally attended with immediate symptoms; but the witnesses for the defence properly admitted that "a concussion of the brain (and spine?), attended with apparently slight symptoms at first, might, under peculiar circumstances, be followed by serious symptoms." As no other cause could be assigned for the symptoms, this was practically admitting that the plaintiff had suffered from the injury, the degree being simply a question for the jury. They returned a verdict for the plaintiff.

Concussion distinguished from intoxication.—The symptoms under which a wounded person is labouring may be sometimes attributed to *intoxication*, and a medical witness may be asked what difference exists between this state and that of concussion. The history of the case will, in general, suffice to establish a distinction, but this cannot always be obtained. It is commonly said that the odour of the breath will detect intoxication; but it is obvious that a man may meet with concussion after having drunk liquor insufficient to cause intoxication, or concussion might take place while he is intoxicated,—a combination which frequently occurs. Under such circumstances we must wait for time to develope the real nature of the case; but concussion may be so slight as sometimes closely to resemble intoxication; and in the absence of all marks of violence to the head, and in the existence of a spirituous odour in the breath, the medical examiner might be easily deceived. If there be no perceptible odour in the breath, the presumption is that the symptoms are not due to intoxication. On the other hand, intoxication may be so great as to give rise to the apprehension of fatal consequences, and the co-existence of a mark of violence on the head might lead to error in the formation of an opinion. What is the line of conduct to be pursued on such occasions? The examiner should weigh all the circumstances, and if there be one cause for the symptoms more probable than another, he should adopt it:—if there be any doubt, this should be stated to the Court.

There is nothing in the state of the brain in a dead body, which will enable a practitioner to distinguish whether concussion or intoxication has been the cause of the symptoms. The vessels may be congested in both cases. The discovery of alcoholic liquid in the stomach may lead to a presumption that deceased had been intoxicated, while marks of violence on the head may favour the view that he had suffered from concussion.

When both conditions are found, the examination of the body cannot lead to a solution of the question. The answer must then depend on the special circumstances proved, and on the nature of the symptoms preceding death.

It is to be feared that medical witnesses are not sufficiently careful, on these occasions, to determine whether there are any signs of intoxication about an injured person. Subsequent proceedings may render this a material part of the inquiry. In November, 1851, the house-surgeon of a London hospital was severely reprimanded by a magistrate, in consequence of an omission to inquire and satisfy himself whether, in addition to the results of violence, a policeman, who was brought to the hospital, was or was not intoxicated when admitted. The question was of importance; the injuries to the head might have arisen from a fall; and a drunken man might readily meet with such injuries from accident. A person was charged with an assault on the policeman, but upon very suspicious evidence; and, in fact, could intoxication have been proved or rendered probable, there would have been no ground for the charge. The medical man had already certified that the patient was not intoxicated, but when pressed in cross-examination, could not say whether he was or was not. The case was immediately dismissed. There can be no excuse for not making an inquiry into the precise condition of an injured person, and arriving at the best judgment of which the case admits. A state of intoxication often renders it difficult to form an accurate opinion in cases of alleged criminal wounding. Some instructive cases, in reference to this complication of wounds, have been published by M. Tardieu. (See Med. Gaz. vol. 44. p. 347.)

Extravasation or effusion of blood.—A blow on the head may destroy life by causing an effusion of blood on the surface or in the substance of the brain. In pugilistic combats, when a person is thus struck, he commonly falls, and death may take place in a few minutes. On inspection, blood may be found effused either at the base or in the ventricles of the brain, and the question will arise—Did the injury which caused death arise from *a blow or a fall?* Two cases of this description are reported by Dr. Wharrie. The men were knocked down by blows with the fist, and they were taken up dead. (Cormack's Monthly Jour. Feb. 1846, p. 117.) It is not easy to give an answer to this question, and its relevancy in a legal view is not apparent; for as it is presumed the blow was the cause of the fall, it is fair to infer that the assailant should be responsible for the effects of either or both. In a case of this kind (*Reg.* v. *Williams*, Denbigh Lent Assizes, 1856), in which deceased had received a blow and sustained a fall, and his death was proved to have resulted from the violence, the judge directed the jury, if the death was caused by "the fighting," to return a verdict against the prisoners. They, however, persisted in returning a verdict of not guilty; assuming that the fatal injury was caused by the fall and not by the blow! A heavy blow on the head may cause fatal effusion of blood; but in these instances the effusion more commonly arises from the violent concussion which the injured person sustains by the fall. A medical witness will therefore in general be compelled to admit that the fatal effusion might have taken place either from a blow or a fall.

This subject has important applications in legal medicine, for this is one of the most common causes of death in injuries to the head, and there are generally many cases of this description tried at the assizes. Effusion may occur from violence, with or without fracture, and it may take place without being accompanied by any external marks of injury to the head. In the *Queen* v. *Phelps* and others (Gloucester Aut. Ass. 1841), it was proved that there was great effusion of blood, and even laceration of the brain, in the deceased, without any corresponding external injuries. (See also, at the same Assizes, the case of the *Queen* v. *Thomas*.) The late Dr. Griffiths, the American editor of this work, mentions a case which was the subject of a trial at Massachusetts, in which a person received a blow from a small stone, and died in ten minutes. On examination there was no external bruise or fracture of the bones: the ventricles were filled with coagulated blood, and all the vessels were gorged with blood. It is remarkable that the skull was in this instance unusually thin (p. 287, Amer. ed.). The chief source of the effusion in violence to the head arises from a rupture of the meningeal artery, and this may occur from the mere shock or concussion, with or without a fracture of its bony canal. The blood thus effused acts by compressing the brain; this compression does not always cause death unless the blood is in large quantity, or unless it is effused in or around the base of the brain (medulla oblongata). Thus the hemispheres will bear a degree of compression which, if it affected that portion of the base of the brain from which the spinal marrow proceeds, would instantly destroy life. The most fatal effusions, therefore, are those which take place in a fracture of the base of the skull, whereby one or both lateral sinuses are commonly ruptured. There may, however, be laceration of the brain, with effusion of blood to some extent at the base, and yet the person may survive some days. Dr. Paterson, of Edinburgh, communicated to me a case which occurred in February, 1854, in which a woman survived severe injuries to the head, supposed to have been inflicted by her husband, for a period of *twelve days*. She was insensible during the whole of this time, but some of the external marks of violence had nearly disappeared, and others had undergone the usual changes in colour. A severe blow had obviously been inflicted on the summit of the head. On inspection after death it was found that there had been laceration of the brain by counter-stroke, and a large clot of blood was observed to occupy the lacerated part, extending over the surface of the base of the brain and into the ventricles. In this case, the woman survived a severe injury for an unusually long period. In the case of *Cuming* (Edinburgh, Dec. 1853), the deceased, the wife of the prisoner, died on the 8th of Nov., from laceration of the brain produced by blows on the head, inflicted by the prisoner, on the 26th of Oct. The woman lay in a state of insensibility during the whole period of thirteen days.

In cases of injuries to the head proving fatal by *effusion* of blood on the brain, a person may recover from the first effects of the violence, and apparently be going on well, when he will suddenly become worse, and die. Effusion takes place slowly at first,—it may be arrested by the effects of stupor from concussion, by a portion of the blood coagulating around the ruptured orifices of the vessels, or by some other mechanical impediment to its escape; but after a longer or shorter period, especially if the person be excited or disturbed, the bleeding will recur, and destroy life by producing compression. How many hours or days are required in order that such an increased effusion should take place, after an accident, it is impossible to say; but in severe cases, it is generally observed to follow the injury within a short time. Sir Astley Cooper has related the case of a gentleman who was thrown out of a chaise, and fell upon his head with such violence as to stun him in the first instance. After a short time he recovered his senses, and felt so much better, that he entered the chaise again, and was driven to his father's house by a companion. He attempted to pass off the accident as of a trivial nature, but he soon began to feel heavy and drowsy, so that he was obliged to go to bed. His symptoms became more alarming, and he died in about an hour, as it afterwards appeared, from effusion of blood on the brain.

Effusion of blood from disease or violence. Diagnosis.—Blood may be found effused in various situations within the interior of the skull; and the cause of the effusion may be either disease or violence. The skill of a medical jurist is often required to determine which of these causes is the more probable, as where, for instance, a pugilist has died after having received severe injuries to the head, and his adversary is tried on a charge of manslaughter. On these occasions, it is often urged in the defence, that the fatal bleeding might have arisen either from a diseased state of the vessels of the brain, or, if the evidence render it probable that the blow was the cause,—that the effects of the blow were aggravated by a diseased condition of the vessels, or by the excitement into which the deceased was thrown, either from the effects of intoxication or passion. When the brain is not lacerated by violence, the blood is effused either on the surface of the hemispheres, between the membranes, or at the base. When the effusion is caused by violence, the effused blood is not always found under the spot where the blow was inflicted, but occasionally, by counter-stroke on the surface of the brain, directly opposite to it: — a case which a medical witness has frequently been required to explain on trials, and which depends on the same cause as fracture by counter-stroke, *i.e.* on a separation of parts (laceration of the brain, effusion of blood, or even fracture of the bones) at the point of the skull directly opposite to that which sustains the violence. Dr. Paterson's case above related (*ante*, p. 343) furnishes a good instance of extensive injury by counter-stroke. A severe blow had been inflicted on the summit of the head, as the mark was plainly visible, but the fatal injury was found in the base of the brain, *i.e.* on the part opposite to that which received the blow. Here the brain was lacerated and blood effused. Again, fracture of the base of the skull is frequently the result of severe violence applied to the summit. (See case by Dr. Haworth, Med. Gaz. vol. 36. p. 368.) Effusions of blood from a diseased state of the vessels more commonly take place in the substance of the brain, but they sometimes occur on the surface of the organ as a result of mere excitement or over-exertion of the muscular powers. A diseased condition of the vessels, and probably a softening of the substance of the brain, will in these cases be apparent on inspection.

A mere inspection of the body does not always lead to the discovery of the cause of an effusion on the brain. The violence causing an effusion of blood may have been slight, and unless attention is particularly directed to the subject, it may be overlooked. In the case of a female who died in a London hospital, in August, 1857, there was no fracture of the skull, or external injury to account for effusion of blood on the brain. The brain was not injured, and in fact there was no apparent cause of death but the effusion, and this was somewhat precipitately assigned to disease. A certificate of death from "apoplexy" was given, and the deceased was buried. It subsequently transpired that she had been maltreated by her husband, and that the effusion of blood was owing to the maltreatment! The condition of the effused blood should be accurately noticed, in order to determine whether it presents any marks indicative of its being recent or of old standing.

Effusion of blood from excitement.—When engaged in the investigation of a case of this kind, it is always a fair matter of inquiry whether the *violence*, upon the evidence, was not of itself sufficiently great to account for the effusion of blood without the supposition of coexisting disease or excitement. Admitting that the rupture of a blood-vessel, and the extensive effusion of blood on the brain, may take place from simple excitement and passion, yet this is an event comparatively rare, at least in the young and healthy, while nothing is more common than that these results should follow violent injuries to the head, whatever the age or condition of the person. A medical witness should remember that on these occasions, if he is unable to say positively whether the effusion was due to the excitement or the blows, he will satisfy the Court if he only state clearly that which is, in his own mind, the more probable cause of death; and by weighing all the circumstances of the case exactly beforehand, he will rarely fail to find that one cause was more probable than the other. Thus, if a man, excited by passion and intoxication, is struck on the head, and the blow is slight—such as an unaffected person would probably have sustained without injury—yet in this case insensibility and death follow, and, on examination, a quantity of blood is found effused in the substance of the brain, can it be a matter of doubt with the practitioner that the effusion was chiefly due to the excitement under which the deceased was labouring? To take a converse instance: a man engaged in a personal conflict with another, is struck most violently on the head, or falls with great force on that part of the body: on inspection it is found that death has arisen from effusion of blood on the surface of the brain, and it would be no unexpected consequence of the violence inflicted that a similar appearance should be met with in an individual calm and unexcited:—Can the practitioner hesitate to say, under these circumstances, that the blow would satisfactorily account for the effusion, without reference to any coexisting causes of excitement? These may be allowed to have their influence, in giving an increased tendency to cerebral hæmorrhage, or in aggravating the consequences of the blow, but no further.

Effusion of blood causing death after a long period of time.—Admitting that blood has been effused on the brain as a result of violence, the person injured may survive the effects for so long a period as to create a legal doubt whether death can be strictly assigned to the violence. In this respect the case of *Reg.* v. *Sullivan* (C.C.C. Sept. 1853) is of some interest. I am indebted to Drs. M'William and Stevens, who gave evidence at the trial, for the particulars of this case. Deceased, who had been previously a healthy man, was knocked down by the prisoner, and fell with his head upon the ground. He appeared as if he was stunned, and staggered in attempting to walk: he complained of pain in the head and general weakness. This was on the 11th April, 1853. Although he suffered from pain in the head, he had no medical advice until the 12th May, and had performed his duties as an officer of the Customs. After this he suffered from dimness of sight, and became delirious. On the 29th he came under the care of Dr. M'William. There were marks of bruises on the head, there was impairment of vision, a faltering gait, and other symptoms indicative of pressure on the brain. He improved under treatment, but the symptoms returned in an aggravated form about the 12th June. He became insane, and was transferred to St. Luke's Hospital. Dr. Stevens, under whose care he was placed, stated that deceased had delusions, and was evidently suffering from pressure on the brain. He recovered so far that he was about to be discharged, when the symptoms of pressure became aggravated, and death took place on the 17th August, *i. e. four months* after the infliction of the violence. On inspection a shot was found imbedded in the frontal bone, not penetrating the skull. A large clot of blood existed between the layers of the arachnoid membrane, occupying the whole surface of the left hemisphere. The clot had evidently been there for some time, because it was partially invested with a false membrane. No large vessel was ruptured; there had probably been an escape of blood at different times, and this would explain the intermittent nature of the symptoms. The clot amounted to at least two fluid ounces, and the surface of the brain had been obviously indented by its pressure. Another clot of old standing was found in the pons varolii. The witnesses concurred in attributing death to the effusion of blood on the brain, and the effusion to the violence inflicted by the prisoner, although it was admitted to be probable that some additional effusion had taken place just before the last fatal recurrence of symptoms. The prisoner was convicted of manslaughter. The fact that the deceased had been healthy previous to the violence, and that after this he had constantly suffered more or less from symptoms of pressure on the brain, fully justified the medical opinion in spite of the protracted nature of the case. There was no other cause but the violence to account for the effusion and death.

WOUNDS OF THE FACE.

When wounds of the face are of any extent, they are usually followed by great deformity; and when they penetrate the cavities in which the organs of the senses are situated, they often prove fatal, either by involving the brain and its membranes, or by giving rise to inflammation in this organ. Wounds of the eyebrows are not of so simple a nature as might at first sight be supposed. Besides being attended by deformity when they heal, they are liable to give rise, during the process of healing, to serious disorders of the neighbouring parts. Amaurosis and neuralgia are recorded among the secondary and not unusual consequences of such wounds, when the supra-orbitar nerve has become implicated. Under certain conditions of the system, there may be inflammation of the parts within the orbit, extending by contiguity to the membranes of the brain, and proving fatal by leading to the formation of matter within that organ. Amaurosis in the right eye has been known to occur from a contused wound, not of a violent nature, to the right eyebrow. Dr. Wallace, of New York, has reported two cases of amaurosis following blows over the infra-orbitar nerve. (Med. Gaz. vol. 31. p. 931.) Wounds apparently confined to the external parts of the face, frequently conceal deep-seated mischief. A sharp instrument penetrating the eyelid, and passing upwards with any force, will produce fracture of the orbitar plate of the frontal bone, which is known to be extremely thin, and even injure the brain beyond.

Wounds of the orbit.—Sir Astley Cooper relates, that a girl, while playing with a pair of scissors, accidentally fell, and the point of the scissors passed upwards under the upper eyelid. It was found difficult to extract them: the eye became inflamed, but for some days after the accident the child was in the habit of walking a considerable distance daily to receive medical advice. In about ten days she suffered violent pain, with symptoms of inflammation of the brain, under which she died. On inspecting the body, it was found that the orbitar plate of the frontal bone had been fractured, the dura mater torn, and the anterior lobe of the brain lacerated. (For a similar case, see Med. Gaz. vol. 41. p. 553.) In several instances in this country, trials for murder have taken place, in which death has been caused by a penetrating wound of the orbit, leading to fracture of the orbitar plate and injuring the brain.

Wounds of the nose.—These wounds are, generally speaking, of a simple nature, rarely giving rise to serious symptoms: but they are almost always attended with great deformity. If the injury be contused and, at the same time, extensive, a loss of the faculty of smelling will probably result. A penetrating wound of the nose, produced by passing a sharp-pointed instrument up the nostril, may destroy life by perforating the cribriform plate of the ethmoid bone, and injuring the brain. Such a wound, it is obvious, might be produced without leaving any external marks of injury. The late Dr. Corkindale, of Glasgow, met with a case in which a man died in nine weeks from the effects of a wound of the nose, whereby the nasal bones were fractured. On inspection, there was copious inflammatory effusion at the surface of the brain, particularly at the part corresponding to the seat of the violence. An injury to the bones of the nose may prove fatal by giving rise to an attack of tetanus. A case of this kind has been elsewhere related (*ante*, p. 320).

Deformity as a consequence of wounds of the face.—Wounds of the face, when at all extensive, are always followed, in healing, by greater or less *deformity*. A medical witness may perhaps find these questions put to him in relation to them. Is the wound likely to be attended with deformity? Could such a wound of the face heal without deformity? or, Could the deformity, if it exist, have been produced by any other cause than the wound? These questions are of some importance. A person may allege that he was severely wounded in the face, when the medical witness, on examination, may find no trace of such a wound as that described. Again, a person may seek damages from another in a civil action, by alleging that a particular deformity was produced by a wound, when the medical witness may be able to trace its origin to disease, or to some accidental cause.

INJURIES TO THE SPINE.

Injuries to the spine and spinal marrow seldom require medico-legal investigation; but this organ is liable to *concussion* from blows, to compression from fracture of the vertebræ, or the effusion of blood, with all the secondary consequences attending such accidents. Concussion of the spinal marrow commonly produces paralysis, affecting the bladder, rectum, or lower extremities. These symptoms may not appear at once, but come on after some hours or days. (*Bowling* v. *S. E. Railway*, Exchequer, Feb. 1859.) After death no traces of mechanical injury may be discovered. Blows on the spine, unattended with fracture or dislocation, may, according to the observations of Sir B. Brodie, be followed by inflammation and softening of the spinal marrow. A slight injury has been known to cause death by giving rise to inflammation of the spinal marrow. (See Henke's Zeitschrift der S. A. 1840, ii. 407.) This organ is also liable to compression from slight causes.

Fractures of the vertebræ.—These fractures are generally attended by displacement, and thus produce compression of the spinal marrow. They are the more rapidly fatal, in proportion as the injury is high up in the vertebral column. The whole of the body becomes paralyzed below the seat of injury, by the compression of the spinal marrow. If the seat of compression be above the fourth cervical vertebra, death is commonly immediate: asphyxia results from paralysis of the phrenic nerves. In falls on the summit of the head from a height, it sometimes happens, not only that the skull is extensively fractured, but that the dentiform process of the second vertebra is broken off, owing to the head being doubled under the body. This injury to the second vertebra may be the cause of death. From a case related by Mr. Phillips, it would appear that this accident is not always attended by fatal compression of the spinal marrow. (E. M. & S. J. Jan. 1838.) In one instance the individual survived fifteen months (ib. Oct. 1845, p. 527); and in another, in which the fracture was caused by the patient turning in bed while his head was pressed on the pillow, death did not take place for *sixteen* months. (Copland, Dict. Pr. Med., Paralysis.) On several criminal trials, this injury was proved to have been the cause of death: and in a case tried at Glasgow (the *King* against *Reid*), it became a material question, how far such a fracture might result from disease. It may happen that caries of the bone or disease of the transverse ligament will cause a separation of the dentiform process from the second cervical vertebra. The state of the bone in these alleged fatal accidents should, therefore, be closely examined. In Reid's case an acquittal took place, partly because the deceased had laboured under disease of the spine, and the exact state of the parts had not been noticed. Disease of the ligaments may also lead to a separation, followed by slow or rapid death, according to the degree of pressure. A slight cause may sometimes produce severe and fatal injury to the neck. A man while holding his head in a butting position during a struggle with a friend died suddenly. The friend had forcibly rotated or twisted the deceased's head a few times from side to side by the brim of his hat. On inspection, it was found that the four first cervical vertebræ were fractured—the ligaments were bruised and torn, and blood was effused on the coverings of the spinal cord. This fully accounted for death. (Med. Times and Gaz. May 17, 1856.) It is not stated whether there was any disease of the bones.

Injuries to the spine and its contents are generally the result of falls or blows either on the head or the lower part of the column. The secondary consequences of these injuries are sometimes so insidious as to disarm suspicion, and death may take place quite unexpectedly some weeks after the accident. Spicula of bone separated by fractures may remain adherent for some time; and by a sudden turn of the head, be forced off and destroy life by penetrating the spinal marrow, at a long period after the infliction of the injury. This has been known to happen in fractures involving the margin of the foramen magnum, and in such cases death is immediate. The spinal marrow has been in some instances wounded in its upper part by sharp-pointed instruments introduced between the vertebræ. Death is an instantaneous result when the wound is above the third cervical vertebra:—there is no part of the spine where a weapon can so readily penetrate as this, especially if the neck be slightly bent forward. The external wound thus made may be very small, and if produced with any obliquity by drawing aside the integuments, it might be easily overlooked, or it might be set down as superficial. For a medico-legal account of a case in which death occurred from a stab in the back of the neck, causing a division of the spinal marrow, see Henke, Zeitschrift der S. A. H. ii. 1836; and for another case of homicidal injury to the spine, reported by Dr. Eade, see Lancet, May 1855, p. 520.

In fractures of the vertebræ a person is generally so disabled, whatever may be the situation of the fracture, that he cannot walk or exert himself. We must be prepared, however, for exceptions to this common surgical view of such injuries. On the 27th February, 1861, a man æt. 35, was admitted into the Northampton Infirmary suffering from paralysis of the legs and great pain in the back and in the abdomen. He could give no intelligible account of the cause of his illness. He soon died; and on a *post-mortem* examination, the tenth dorsal vertebra was found broken in its body and arch. There was slight displacement but it was not such as to press upon the spinal cord. A large clot of blood was situated on the sheath of the cord. This had caused the paralysis. It was proved at the inquest that deceased met with a heavy fall on the 15th of February, but that he walked some distance afterwards, visited several public-houses, went home intoxicated, and lay down to sleep in a yard. He awoke in the morning sober, but was unable to move his legs. In addition to paralysis the man when admitted was labouring under peritonitis. There was no evidence that he had sustained any injury subsequently to the fall twelve days before his admission; hence there was reason to believe that in spite of the fractured vertebra he had not been rendered incapable of motion. There is no doubt that the effusion of blood was the cause of the paralysis, and this did not occur until some time after the fracture, as a result of slow oozing. (See for a case somewhat similar, *ante*, p. 248, also the case of *Slater* and *Vivian*, C. C. C., Sept. 1860. INSANITY, *post.*)

CHAPTER 35.

WOUNDS OF THE CHEST — OF THE LUNGS — RUPTURES FROM ACCIDENT — WOUNDS AND RUPTURES OF THE HEART — WOUNDS OF THE AORTA AND LARGE VEINS — WOUNDS AND RUPTURES OF THE DIAPHRAGM — DIRECTION OF WOUNDS OF THE CHEST—WOUNDS OF THE ABDOMEN—DEATH FROM BLOWS ON THE ABDOMEN — RUPTURES OF THE LIVER, GALL-BLADDER, SPLEEN, KIDNEYS, INTESTINES, STOMACH, AND URINARY BLADDER — MEDICO-LEGAL QUESTIONS CONNECTED WITH RUPTURED BLADDER — WOUNDS OF THE GENITAL ORGANS—MUTILATION.

WOUNDS OF THE CHEST.

WOUNDS of the chest have been divided into those which are confined to the parietes or coverings, and those which penetrate the cavity. This division is important, so far as it relates to the prognosis of such injuries. Incised or punctured wounds of the parietes of the chest are rarely followed by dangerous consequences. The loss of blood is not considerable, and is generally arrested without much difficulty. They heal either by adhesion or suppuration, and unless their effects be aggravated by incidental circumstances, the prognosis is very favourable. Contusions or contused wounds of the chest are, however, far more dangerous, and the danger is always in a ratio to the degree of violence used. Such injuries, when severe, are ordinarily accompanied by fractures of the ribs or sternum,—by a rupture of the viscera within the cavity, including the diaphragm,—by profuse bleeding,—or, as an after-effect, by inflammation of the organs, with or without suppuration. Fractures of the ribs are dangerous for several reasons: the bones may be splintered and driven inwards, thereby wounding the lungs and causing loss of blood, or leading to inflammation of the pleura or lungs. The fracture of one rib may thus prove fatal, without any external marks of violence being produced. (Med. Times and Gaz., Dec. 12, 1860, p. 607.) In fractures of the upper ribs, the prognosis is less favourable than in those of the lower, because commonly a much greater degree of violence is required to produce the fracture. A simple fracture of the sternum, without displacement of the bone, is rarely attended with danger, unless the violence has at the same time produced mischief internally, which will be known by the symptoms. When, however, the bone is depressed as well as fractured, the viscera behind may be mortally injured. In a case of depressed fracture of the sternum, recorded by M. Sanson, the individual died after the lapse of thirteen days; and on inspection it was found that the fractured portion of bone had produced a transverse wound of the heart, about an inch in length. The cavities of the organ had not been penetrated, but the piece of bone was exactly adapted to the depression produced by it on the parietes. (Devergie, Méd. Lég. vol. 2. p. 243.) A practitioner will frequently be required to take into consideration the effects of contusions on the chest, with or without fracture, in cases of death from pugilistic combats, which have given rise to numerous trials on charges of manslaughter. Cuts or stabs penetrating the cavity of the chest are generally dangerous, even when slight, in consequence of the numerous accidents with which they are liable to be complicated. In these wounds the lungs are most commonly injured: but, according to the direction of the weapon, the heart, or the great vessels connected with it, as well as the gullet and thoracic duct, may share in the mischief.

Wounds and ruptures of the lungs.—The immediate cause of danger from wounds of these organs is the consequent loss of blood, which is profuse in proportion to the depth of the wound and the size of the vessels wounded. Should the weapon divide any of the trunks of the pulmonary veins, the individual may speedily sink. The degree of hæmorrhage cannot be determined by the quantity of blood which escapes from the wound; for it may escape internally, and collect within the cavity of the pleura, impeding the respiratory process. This is especially to be apprehended when the external orifice is small and oblique, and one of the intercostal arteries has been touched by the weapon. A wound of the lung is generally known, among other symptoms, by the frothiness and florid colour of the blood which issues from the orifice, as well as by the expectoration of blood. The lungs may sustain serious injury from a blow or fall, and yet there may be no external marks of violence or symptoms indicative of danger for some hours. A young man, while riding, fell from his horse on his left arm. He complained of no pain for five hours, but in twelve hours he was seized with an alarming flow of blood from the mouth. He died in the course of a few days. After death there was no mark of injury to the chest, but the right lung was ruptured posteriorly throughout its length, and much blood had been effused. (Lancet, November 1842.) A case somewhat similar to this is reported by Mr. Jardine, of the Winchester County Hospital. (Med. Times and Gaz., Dec. 31, 1853.) A boy, aged fourteen, fell to the ground from a height of about twenty feet. He was admitted an hour after the accident, and he died in about two hours after his admission. On examination of the body twelve hours after death, there was no mark of external injury. The collar-bone was fractured, but the ribs had escaped injury. The right lung was found ruptured to the depth of four inches into its substance, and from this a large quantity of blood had escaped, which caused death. This case furnishes another illustration of the production of fatal internal injuries without any corresponding marks of violence externally. (See p. 239.) For another case of laceration of the lung without fracture of the ribs from a carriage passing over the chest, see Med. Times and Gaz. Jan. 19, 1861. During the convalescence of an individual who has survived the first effects of a penetrating wound of the chest, the surgeon should observe whether death, when it occurs, may not have been caused by imprudence on the part of a patient, or by abuse of regimen or other misconduct; for circumstances of this nature may be occasionally regarded as mitigatory on the trial of an aggressor. It is properly recommended, that in all cases where a party is progressing to recovery, a relaxation of the antiphlogistic regimen should be made with great circumspection. Too much nourishment, too frequent talking, or any exertion, are circumstances that may cause a renewal of the bleeding and extravasation. A case is related, in which a soldier died instantly from internal hæmorrhage, brought on by throwing a bowl at some nine-pins, two months after he had been apparently cured of a wound of the lungs. (Some remarks on penetrating wounds of the lungs will be found in Med. Times and Gaz. July 24, 1858, p. 98.)

Wounds of the heart.—Wounds of the heart are among the most fatal of penetrating wounds of the chest. It was formerly considered that all wounds of this organ were necessarily and instantly mortal. (See *ante*, p. 331.) Undoubtedly, when either of the cavities is laid open to a large extent, the bleeding is so profuse on the withdrawal of the weapon, that death must be immediate. But when the wound is small, and penetrates into the cavities of the heart obliquely, life may be prolonged for a considerable period; and cases are on record in which it is probable that such wounds would have healed, and the patients have finally recovered, but for the supervention of other diseases which destroyed life. Dupuytren has reported the case of a man who received a stab on the left side of the chest, on November 5th, 1831. He was brought to the Hôtel Dieu, but the symptoms under which he laboured did not lead to the suspicion that he had received a wound of the heart. The man died in eight days, of cerebral disease. On an inspection of his body, it was found that the left ventricle was wounded about the middle and a little to the right: its cavity having been penetrated in a transverse direction. The wound was three lines and a half across, and one line from above downwards. The external fibres of the organ were most separated: the openings diminished gradually, so that the internal fibres were in contact and closed the wound. A boy, in pulling a knife from a companion with the point towards him, accidentally stabbed himself in the chest. A small quantity of florid red blood escaped; he vomited, and fell to the ground. He died in eight days. The left ventricle had been perforated, and one pound and a half of blood was effused in the chest. This case shows that fatal hæmorrhage is not always immediate. (Med. Gaz. vol. 2. p. 721.) In another instance recorded by Dupuytren, five or six wounds were made by means of a saddler's needle,—most of them penetrating into the right ventricle of the heart. This man died of cerebral disease, twenty-five days after the wounds could have been possibly inflicted; for the needle was taken from him twenty-five days before his death, without any suspicion being entertained of his having wounded himself with it. The external cicatrix was visible on an inspection of the body. The quantity of blood found in the chest amounted to about three ounces, and this appeared to have proceeded from the substance of the heart. (Med. Gaz. vol. 13. p. 662.) For a case of sudden death as the result of an accidental wound by a fish-bone, see Med. Times and Gaz., May 12, 1860, p. 667; and for cases in illustration of the fact that wounds of the heart are not instantaneously mortal, see Med. Gaz. vol. 2. p. 721.

It was the opinion of Dupuytren, that these injuries were not necessarily fatal, although I believe, with one exception (*infrà*), there is no case on record in which a person has recovered from a penetrating wound of the cavities of the heart. (Ed. M. and S. J. Oct. 1844, 557; also Ann. d'Hyg. 1846, t. 1. p. 212.) There are few, probably, who will be inclined to consider them curable; a remote possibility of simple wounds healing, and of the patient recovering, may be admitted; but until some clear instances of recovery from penetrating wounds of the cavities are reported, the majority of practitioners will continue to look upon them as fatal. From a series of cases collected by MM. Ollivier and Sanson, it appears that out of twenty-nine instances of penetrating wounds of the heart, only two proved fatal within forty-eight hours. In the others, death took place at the varying periods of from four to twenty-eight days after the infliction of the wound. (Devergie, Méd. Lég. vol. 2. p. 253.) These differences in the time at which death occurs, as well as the fact that wounds of the heart do not instantly destroy life, have been ascribed to the peculiar disposition of the muscular fibres of the organ, and to the manner in which they are penetrated by a weapon. Thus, as a general principle, it is stated that wounds which are parallel to the axis of the heart are, *cæteris paribus*, less rapidly fatal than those which are transverse to its axis. In a wound which divides the fibres transversely, the opening will be larger, and the hæmorrhage greater, than in one which is parallel to these fibres; and as the heart is composed of different layers, of which the fibres pass in different directions, so, in a penetrating wound of its cavities, while one set tends to separate the edges, another tends to bring them together, and thereby to restrain the flow of blood. It is this action of the fibres which renders wounds of the ventricles less rapidly fatal than those of the auricles, all other circumstances being equal (see case by Mr. Callaway, *ante*, p. 332); but a man has been known to survive a laceration of the left auricle eleven hours. In the 17th volume of the Medical Gazette, page 82, a case is reported in which a person is stated to have recovered from a punctured wound of the heart; and Dr. Trugien met with a case in which a man who had been stabbed in the left ventricle survived *five* days. The wound in the heart had partly cicatrized. (See Med. Gaz. vol. 47. p. 42.) In reference to penetrating wounds of the chest, it may be proper to state that the base of the heart corresponds to the upper margin of the third rib on the left side; and the apex to the lower margin of the fifth rib on the same side.

Ruptures of the heart. — The heart is liable to be *ruptured* either from disease or accident. In the latter case, the organ generally gives way towards the base, and through one of the cavities on the right side. (For cases, see Med.-Chir. Rev.

vol. 31. p. 532.) Dr. Hope asserts that in ruptures from natural causes, it is the left side of the heart, and particularly the left ventricle, in which a rupture is most frequently found. The symptoms are sudden pain, collapse, cramps, cold extremities, and rapid death. According to the circumstances under which they occur, cases of rupture from disease may excite a suspicion of death from violence. Sometimes the substance of the heart appears to have undergone a fatty degeneration. Dr. Quain met with a case in which, under this diseased condition, the left ventricle had become ruptured during slight muscular exertion. (Med. Gaz. vol. 38. pp. 774 and 857.) Mr. Marshall has reported a case of rupture of the right ventricle under similar circumstances. (Lancet, Feb. 16, 1857.) In other instances there has been no apparent alteration of structure. Dr. Stroud reported to the Med.-Chir. Society, a case of this kind, which occurred in a young man aged twenty-nine. The deceased died in ten hours after his first seizure; on inspection there was a small aperture in the right auricle near the vena cava. This did not appear to be connected with any morbid condition of the heart. (Med. Gaz. vol. 26. p. 518; Lancet, Nov. 1843.) As a medico-legal subject, it is worthy of note that when this alarming accident proceeds from blows or falls, it is not always accompanied by marks of external violence,—or any fracture or other injury to the exterior of the chest. The *natural* causes of rupture of the heart are violent mental emotions, such as anger, fright, terror, paroxysms of passion, sudden or excessive muscular efforts, or violent physical exertions in constrained positions. The heart, like any other muscle, may also give way from its own powerful contraction. The left auricle of the heart has been ruptured as a mere result of great physical exertion. (See case, Med. Gaz. vol. 47. p. 1063.) Rupture of the heart from any of these natural causes is, however, a rare occurrence. (Med.-Chir. Rev. Oct. 1847, p. 460: Lancet, Jan. 28, 1860, p. 88; and Gamgee's Pathological Anatomy, p. 7.)

Wounds of arteries and veins.—Wounds of the large arterial and venous trunks, around the heart, must be considered as decidedly mortal: death is generally instantaneous from the sudden and profuse bleeding which attends them. Dr. Heil, of Bamberg, has related a case which he considers to prove that a person may recover from a penetrating wound of the *ascending aorta.* (Henke's Zeitschrift, 1837, b. 2. s. 459.) With regard to these fatal effusions of blood within the chest, as well as in the other great cavities, it may be proper to mention that, from whatever vessel or vessels the blood may have issued, it is not commonly found coagulated to any extent. The greater part of it generally preserves the liquid state: and it is rare that so much as one half of the quantity effused is met with in the form of coagulum. These effusions of blood in the chest may be sometimes traced to wounds of the intercostal and the internal mammary arteries or of the vena azygos.

Wounds of the *carotid arteries* have been considered in the section on wounds of the throat (*ante*, p. 254.) Of wounds of the other blood-vessels, whether arteries or veins, it is unnecessary to make any further remark. Death is generally owing to loss of blood, and the bleeding from a comparatively small vessel may prove fatal, according to its situation and the state of the individual.

Death from the entrance of air into wounded veins.—In wounds of *veins* there is an occasional and a peculiar cause of death which requires notice, namely, the entrance of air by the open mouth of the divided vessel. Among many cases of this kind I select one which occurred to Dr. Willis, of Barnes, in March 1848:—A man was labouring under chronic laryngitis, and it was considered proper to introduce a seton at the fore part of the neck. The skin was raised, and the seton-needle was passed horizontally through the skin, about two inches and a half above the breast-bone, and not at all near the jugular vein or any other important blood-vessel. At the instant of its entrance there was a momentary hissing sound,—the man became pale,—his features were set,—he fainted, and he subsequently became rigid and convulsed. The man did not recover his consciousness, was attacked with lock-jaw, and died in seven hours. The medical evidence given at the inquest proved that death had not arisen from loss of blood, but from air penetrating through a small vein which had been accidentally divided. A verdict was returned accordingly. After the inquest the body was inspected, and it was then found that the jugular veins and the large vessels of the neck were uninjured. The right auricle and pulmonary artery were distended with frothy blood, and the lungs were emphysematous. (Med. Gaz. vol. 41. p. 608.) For another case of sudden death from this cause, see Med. Gaz. vol. 43. p. 1098. See also a paper on this subject in the same journal by Mr. Lane, vol. 45. p. 926. Dr. Bernard has shown that the air thus introduced into veins does not act by paralyzing and obstructing the action of the heart: the obstacle which it creates to the circulation, is in the lungs. (Leçons, p. 163.)

It has been long known that air injected into the jugular vein would destroy life by interfering with the functions of the heart. The exact nature of this accident, as it occurs in operations, is not well understood. (Ferguson's Surgery, p. 444.) According to some, the air rushes into the cavity of the vessel owing to atmospheric pressure during the expansion of the heart, while others believe it to be dependent on the act of inspiration. It is difficult to account for the entrance of air by atmospheric pressure, unless the cut orifice of the vein be kept open, or unless its coats be morbidly thickened, so that it does not readily close when divided; nevertheless, death may thus occur without the slightest imputation on the skill of the operator. Dr. Cormack has shown that in some alleged cases of this kind, death was probably due to loss of blood. When the bleeding is slight, and the hissing sound is heard at the time of the incision, it may fairly be ascribed to the entrance of air. This opinion would be confirmed by the discovery of a frothy state of the blood in the right cavities of the heart. It is worthy of remark, that death may take place from this cause, although the person may recover from the first symptoms. A case has been reported in which a man died under these circumstances in thirteen hours, although he had so far recovered in the interim, that the functions of the lungs and heart were completely restored. (Association Journal, Jan. 28, 1853, p. 91.)

Wounds and ruptures of the diaphragm.—The diaphragm, or muscular partition between the chest and abdomen, is liable to be wounded either by weapons which penetrate the cavity of the chest or abdomen, or by the ribs when fractured by violent blows or falls; but, under any circumstances, wounds of this muscle are not likely to occur without implicating the important organs that are in contact with it. It is scarcely possible, therefore, to estimate the danger of these injuries abstractedly, as the medical opinion must materially depend on the concomitant mischief to the adjoining viscera. Slight penetrating wounds of the diaphragm may heal like those of other muscular parts; and cases of this kind are on record. There is, however, especially when the wound is of a lacerated kind, a consecutive source of mischief which no remedial means can avert,—namely, that after the wound has, to all appearance, healed, the life of a person may be cut short by the strangulation of a portion of the stomach or bowels in the half-cicatrized aperture. An instance reported by Dr. Smith affords an illustration of this. A sharp-pointed weapon had penetrated the diaphragm, notwithstanding which the patient apparently made a rapid and perfect recovery. At the end of about three months, however, the man died from a strangulated hernia or rupture of the stomach, which had passed through the wound of the diaphragm into the thorax. (For. Med. p. 279.) In a case of this description, when death occurs at a long period after the infliction of a wound, the witness will probably be required to say—Whether the wound was the cause of death? or whether there were any other circumstances which would have caused or facilitated the production of a hernia. The degree of culpability of an aggressor may materially depend upon the answers returned to these questions. *Phrenic hernia*, as this form of internal rupture is termed, is not by any means an unusual or unexpected fatal consequence of a wound of the diaphragm; and therefore it would appear, at first sight, that death, at whatever period this event may occur, should be referred to the original wound. But the question is of a delicate nature; as it is possible that a slight blow on the stomach, received subsequently to the wound, or even any violent exertion on the part of the deceased, might actually produce the fatal strangulation.

The most serious injuries to the diaphragm are unquestionably those which are produced by violent contusions, or falls on the abdomen, while the stomach and intestines are distended. In these cases the muscular fibres are commonly found ruptured to a greater or less extent: the bleeding is not considerable, rarely exceeding two, three, or four ounces. A uniform result of these *ruptures*, when extensive, is a protrusion of the stomach into the chest, with sometimes a rupture of the coats of that organ and extravasation of its contents. Severe lacerations of the diaphragm are more readily produced during the act of inspiration than during expiration,—the fibres of the muscle being then stretched, and receiving, while in this state of tension, the whole of the force. According to Devergie, the rupture most frequently takes place in the central tendinous structure, where it is united with the left muscular portion above the crura. He has remarked that it is observed more commonly on the left side than on the right. (Op. cit. vol. 2. p. 250.) It has been supposed that death was an immediate consequence of this accident; but this view is not supported by facts. In a case of extensive rupture of the diaphragm, related by Devergie, in which the stomach and colon were found in the chest, the person lived nine months after the only accident which could have produced it, and then died from another cause. Besides the stomach, it sometimes happens that the liver, spleen, or intestines pass through the opening, and, like it, these organs are liable to become strangulated: the lungs are at the same time so compressed that respiration is stopped, and asphyxia or suffocation is often an immediate result.

Direction of wounds in the chest.—In judging of the *direction* taken by wounds which traverse the antero-posterior axis of the chest it is necessary to remember the great difference that exists in the level of the same rib anteriorly and posteriorly. This must be especially attended to when we are called upon to state the direction of a traversing wound from the description of it given by another. The point here referred to had an important bearing in the case of a fatal gun-shot wound which was the subject of a criminal charge some years since. (Henke's Zeitschrift, 1836.)

WOUNDS OF THE ABDOMEN.

Wounds of the parietes.—*Incised and punctured* wounds, which affect the parietes or coverings of the abdomen, without penetrating the cavity, are not quite of so simple a nature as might at first sight be imagined. The danger is immediate if the epigastric artery be wounded; for a fatal hæmorrhage will, in some instances, take place from a wound of this small vessel. *Contusions* are attended generally with far more serious effects on the cavity of the abdomen, than on the chest. This arises from the coverings of the abdomen having less power to resist external shocks. In the first place, death may be the immediate result of a blow in the upper and central portions; no particular morbid changes may be apparent on inspection, and the violence may have been so slight as not to have produced any ecchymosed mark on the skin. Death has been ascribed in these cases to a fatal shock transmitted to the system through a violent impression produced on the solar plexus. Some remarks have already been made on sudden death from blows on this part of the abdomen (see p. 290). Travers, Alison, Watson, Cooper, and other writers on surgical injuries, have referred to cases of this kind as of not unfrequent occurrence. They are of considerable importance in a medico-legal view, as, in the absence of marks of physical injury in the part struck, a jury may be led to doubt whether the blow could have been the cause of death. In *Rex* v. *Jones* (Warwick Summer Assizes, 1831),—a case of alleged manslaughter.—prisoner was charged with having struck deceased several blows on the breast, and one on the pit of the stomach, by which he instantly fell down senseless and expired. On dissection no morbid appearances were found. The prisoner was convicted. (Watson on Homicide, p. 75.) In another case, tried at the Central Criminal Court in Aug. 1841 (*The Queen* against *Sayers*), death was thus caused by violence during a pugilistic combat. The man received a blow in the stomach, and fell dead. As there were no marks of external injury, the surgeon thought the man had died of apoplexy! The prisoner was acquitted. A similar case was the subject of a trial at the Norwich Lent Assizes, 1854 (*Reg.* v. *Laws*). The deceased, a powerful man, received during a pugilistic encounter a blow on the abdomen, and he instantly fell backwards, dead. On an examination of the body there were no marks of injury, either externally or internally. The surgeon attributed death to sudden shock; and this, no doubt, was the true cause. The learned judge left it to the jury to say whether they thought the death of the deceased was caused by a blow; but if they could not say what was the cause of death, or if they should think that death was attributable to excitement and that it was independent of the blow, the prisoner would be entitled to an acquittal. A verdict of Not Guilty was returned. Although the blow was seen to be struck, and was a sufficient cause of death under the circumstances, the jury probably thought that there should be some *visible* injury to the body; and, in the absence of this, declined to refer death to the violence. Had the jury possessed any medical experience or knowledge on the causes of death, they would have seen their way through this apparent difficulty. Blows on the abdomen, when they do not destroy life by shock, may cause death by inducing peritoneal inflammation. Among many instructive cases of this kind, is one recorded by Dr. Allen, in which fatal peritonitis followed a slight amount of violence. (See Lancet, Jan. 5, 1850, p. 29.)

Deeply penetrating wounds of the abdomen are generally fatal by reason of the injury done to the intestines and other organs. In a remarkable case recorded by Mr. Todd, a soldier by accident so fell upon his bayonet, that although the weapon traversed the whole cavity of the abdomen (entering at the back and coming out below the navel), the man recovered in about six weeks. (Med. Times and Gaz., March 30, 1861, p. 329.) This case is of importance in reference to the situation and direction of wounds. (Page 250, *ante.*) Had there been no knowledge of the facts, this accidental wound might have been pronounced homicidal.

Rupture of the liver.—Blows on the abdomen may also prove fatal by causing a rupture of the liver or other viscera, with extravasation of blood: and, as it has been elsewhere stated (p. 240), these serious injuries may occur without being attended by any marks of external violence. Of all the internal organs, the liver and spleen are the most exposed to rupture, owing to their compact structure, which prevents them from yielding to a sudden shock, like the stomach and intestines. Ruptures of the liver may occur from falls or blows; but this organ may be ruptured merely by a sudden action of the abdominal muscles. An accident of this kind happened to a person who was endeavouring to avoid a fall from his horse. (Male's Jur. Med. p. 119.) A fall on the feet from an elevated spot may also determine laceration of this organ. (Ann. d'Hyg. 1846, t. 1. p. 133.) Ruptures of the liver are generally seen on the convex surface, seldom extending through the whole substance of the organ, but consisting of fissures, varying from one to two inches in depth. Their usual direction is from before backwards, with a slight obliquity; they rarely intersect the liver transversely. The lacerated edges are not much separated, while the surfaces present a granular appearance. But little blood is met with in the laceration; it is commonly found effused in the lower part of the cavity of the peritoneum, or in the hollow of the pelvis, and is only in part coagulated. Ruptures of the liver, unless they run far backwards and involve the vena cava, are not in general attended with any considerable effusion of blood; but the bleeding, should this vessel be implicated, is sufficient to cause the instant destruction of life. Under other circumstances, a person may survive some hours (p. 334). The blood may escape only slowly. Rupture of this organ may take place from violence applied to the *chest*, and there may be no marks of injury over the region of the liver. (See case, Med. Times, Aug. 30, 1851, p. 234. For other cases, see Med. Gaz. vol. 47.

p. 156.) Mr. Partridge lately presented at the Pathological Society the liver of a boy who had been run over by a cart. He died almost immediately from loss of blood. There was no external bruising. (Lancet, Jan. 21, 1860.)

Wounds of the gall-bladder. — Wounds and ruptures of the gall-bladder are necessarily attended with the effusion of bile. This irritant fluid finds its way into the cavity of the abdomen, and the person dies from peritonitis. A fatal case of this description occurred to Dr. Maclachlan. An old man while getting out of bed fell with great violence on the floor. He died from peritonitis in forty-eight hours. The gall-bladder was ruptured, and a large stone was found impacted in the cystic duct. (Med. Gaz. vol. 37. p. 968.)

Rupture of the spleen. — Ruptures of the spleen may occur either from violence or disease, and it would appear from the following case, reported by Mr. Heddle (Med.-Chir. Rev., Oct. 1839), that a slight degree of violence is sufficient to rupture this organ, while there may be no marks of injury externally. A middle-aged man was observed fighting with a boy about fourteen years of age, who in stature scarcely reached to his waist. When the fight had terminated the boy ran away: the deceased was observed to become very weak and faint, and he complained of uneasiness in his left side. He expired a few minutes afterwards. On inspection, no mark of violence could be detected externally; but the cavity of the abdomen contained a large quantity of blood. The spleen was found enlarged, and so softened, that its structure was broken down by the slightest pressure. There was a laceration across its surface, about half an inch in depth, from which the fatal bleeding had proceeded. A similar case, in which death occurred in fifteen minutes, is reported in the Medical Gazette, vol. 35. p. 942. The rupture was caused by a blow, but there was no mark externally to indicate that a blow had been struck. A case of spontaneous rupture of the spleen, which was enlarged and in a diseased condition, is reported in the same journal for June 1842. Dr. Easton communicated to me a case (Feb. 1856) in which a little girl died in fourteen hours from rupture of the spleen. The rupture had arisen from the wheel of a cart passing over her body. There was no mark of external violence. It is highly probable, that when the liver and spleen are ruptured from slight causes, the structure of these organs will be found to be in a diseased condition — a circumstance which may in some cases be regarded as mitigatory of the act of an assailant. (See also Med. Gaz. vol. 35. p. 942.)

Rupture of the kidneys.—The *kidneys* are occasionally ruptured from violence; but this appears to be a rare accident. Two cases were reported by Mr. Stanley to the Med.-Chir. Soc. (Lancet, Nov. 1843). In one, the person recovered; in the other, death did not take place for a considerable time. Another case, which occurred in 1847, has been communicated to me by Dr. Beveridge. The injury occurred during a scuffle, but its existence was not suspected during life.

Ruptures and wounds of the intestines.—Ruptures of the intestines sometimes occur from disease; and, in a case of rupture alleged to have been produced by violence, we must always take this possible objection into account. The ruptured part of the bowel should be carefully examined, in order to see whether there are any signs of ulceration or softening about it. If not, and there is clear evidence of violence having been used, it is impossible to admit this speculative objection. If with the proof of violence there should also be a diseased condition of the bowel, we may be required to say whether this did not create a greater liability to rupture,—a point which must be admitted. (For medico-legal cases of ruptured intestines, see Watson on Homicide, p. 159; also, Henke Zeitschrift der S. A. 1836, Erg. H. xxii., and Brit. and For. Rev. vol. 4. p. 519.) The intestines may be ruptured by an accidental fall. (Med. Times and Gaz., April 13, 1861, p. 403.) I am indebted to Dr. Croker King for a report of two fatal cases of ruptured jejunum, one arising from a kick on the abdomen and the other from an accidental fall. Dr. King has observed that persons who have sustained this injury, retain the power of locomotion and muscular exertion.

Punctured wounds, which merely touch the bowels without laying open the cavity, are liable to cause death by peritonitis. These injuries to the intestines sometimes destroy life by shock; there is but little blood effused and the wounded person dies before peritonitis can be set up. Severe wounds to the intestines may, however, be inflicted almost without the consciousness of the individual, and the wounded person may be able to walk a considerable distance. (Med. Gaz. vol. 46. p. 24.)

Wounds and ruptures of the stomach.—Wounds and ruptures of the stomach may cause death by shock: ruptures commonly give rise to severe pain, which of itself is sufficient to bring about rapid dissolution. It is proper to state, however, that the stomach may be ruptured from spontaneous causes, as in cases of ulceration as a result of disease; but sometimes there is no morbid cause apparent. In April, 1828, a man, aged thirty-four, was brought into St. Bartholomew's Hospital, complaining of severe pain in the abdomen. Ten hours afterwards he was seized with violent vomiting; the pain ceased; the vomiting also ceased; and he died in five hours more. The posterior surface of the stomach was found lacerated to the extent of three inches, and the contents of the organ had escaped through the aperture: the mucous membrane was reddened, but there was no thickening, ulceration, or any apparent disease of the stomach. (Med. Gaz. vol. 2. p. 182: see also Dub. Med. Jour., May, 1845; and Ed. Med. and Surg. Jour., Oct. 1845, p. 522.) Penetrating wounds of the stomach generally prove rapidly mortal; they seldom form a subject of medico-legal investigation; but a singular case was tried at the Norwich Assizes in 1832, in which a man was charged with the murder of his wife, by throwing at her a red-hot poker. The weapon completely perforated her stomach, and the woman died in six hours. It might be a question whether this was a *wound* in the common sense of the term; it was an injury compounded of a burn, puncture, and laceration.

Rupture of the bladder.—This injury, which has on several occasions given rise to medico-legal discussion, is frequently the result of blows on the lower part of the abdomen. The principal questions to be answered are;—Was the rupture the result of wilful violence or of an accidental fall? or, Did it proceed from spontaneous causes, as from over-distension? The spot in which rupture commonly takes place is in the upper and back part, where the bladder is covered by the peritoneum. The aperture is sometimes large, at others small; but the effect is, that the urine is effused, and death takes place sooner or later from peritoneal inflammation. It is commonly stated that ruptures, when attended with extravasation of urine into the peritoneal cavity, are uniformly fatal; but if the rupture occurs in the under part of the bladder, or the urine finds its way into the cellular tissue, the prognosis is not so unfavourable. Mr. Syme has reported a case of recovery under these circumstances. (Surgical Contributions, p. 332.)

The usual period at which death occurs from this accident is in from three to seven days; but Mr. Ellis met with a case in which the person did not die until the fifteenth day. The cause of death is obviously peritoneal inflammation: but a person may die suddenly from this injury as a result of shock. Dr. Paterson has communicated a case of this kind to the Association Journal (Jan. 28th, 1853, p. 88.) A man, while struggling with another, received a severe kick in the lower part of the abdomen. He fell backwards, and died immediately. On inspection, the brain was congested, but otherwise healthy:—the heart was free from disease, but much distended with black coagulated blood. The bladder presented, on the left side of the body, a rent of about two inches: but this organ was in other respects healthy, as well as the urethra. There was some bloody effusion in the cellular tissue. The peritoneum and viscera of the abdomen were uninjured. There were no marks of violence on the body.

When these ruptures are produced by blows they are rarely accompanied by the slightest mark of ecchymosis, or of injury to the skin. Thus, then, there may be no means of distinguishing, by an external examination, whether the rupture was really due to violence or to spontaneous causes. They who are unacquainted with this fact, might be disposed to refer the rupture to disease, on the supposition that violence should be indicated by the usual characters externally; but there are numerous cases on record which show that this view is erroneous.

As an attempt may be made, in cases in which death has resulted from this injury, to refer rupture of this organ to natural causes, it may be observed that this is an unusual occurrence: a rupture is almost always the result of violence directly applied to the part, while the organ is in a *distended* state. A *spontaneous rupture* may, however, occur: 1, when there is paralysis, with a want of power to expel the urine; 2, when the bladder is ulcerated or otherwise diseased; 3, when there is an obstruction in the urethra from stricture or other causes. A fatal case of rupture of the bladder arising from obstruction as a result of disease occurred to Mr. Field (Med. Times and Gazette, Dec. 13, 1856, p. 590). The causes of spontaneous rupture are easily recognizable by ascertaining the previous condition of the deceased, or examining the bladder and urethra after death. If a man were in good health prior to being struck,—if he suddenly felt intense pain, could not pass his urine afterwards, and died from an attack of peritonitis in five or six days; if, after death, the bladder was found lacerated, but this organ and the urethra were otherwise in a healthy condition, there can be no doubt that the blow must have been the sole cause of rupture and death. In such a case, to attribute the rupture to spontaneous or natural causes would be equal to denying all kind of causation. As to the absence of marks of violence externally, this would be a difficulty only to those who had not previously made themselves acquainted with the facts attending this and other accidents affecting the viscera of the abdomen (p. 239). Nevertheless, a medical witness must be prepared to hear the same line of defence continually urged; it is, of course, the object of a counsel to make the best of a case for the prisoner, and his duty consists in seeing him judged according to law, and not condemned contrary to law. With medical facts, opinions, and doctrines he does not concern himself, so long as they do not serve his purpose.

Can the bladder be ruptured by an accidental fall, and if so, by what kind of fall?—The following case, reported by Mr. Syme, shows that this accident may readily occur. A woman, aged twenty-six, fell forwards over the edge of a tub, and fainted immediately. On recovering herself, she complained of intense pain in the abdomen, with inability to pass the urine. Peritonitis came on, and she died in a week. On inspection, a small aperture was found in the upper part of the bladder; the peritoneum was extensively inflamed, from the urine which had become effused. The ruptured surfaces had become partly glued together. (Ed. Med. and Surg. Jour., Oct. 1836.) Rupture of the bladder may take place from an accidental fall, and cause death without necessarily laying open the peritoneal cavity. Two cases of this kind have been reported by Mr. Spencer Wells. (Med. Gaz. vol. 36. p. 621.) The patients were sailors who fell from their hammocks while in a state of intoxication. The usual symptoms followed,—one died in five, and the other in eight days, from peritonitis; and after death it was clearly found, in one instance at least, that the bladder had been ruptured in the usual situation, but the peritoneum was entire, although in a state of intense inflammation. Another case of this kind, which was the subject of a trial (*Reg.* v. *Dixon*, Durham Lent Assizes, 1846.) was communicated to me by M. Steavenson. The prisoner kicked the deceased in the pubic region from behind. The man died from peritonitis in thirty-five hours. On inspection, the bladder was found ruptured near its neck for about half an inch, immediately above and to the left of the prostate gland. The urine was extravasated in the cellular tissue of the scrotum: but although there was extensive inflammation, the peritoneum was not lacerated. On the other hand, a remarkable case is reported by Mr. Bower, in which a man died on the sixth day from rupture of the bladder; and after death, although the peritoneum was lacerated, and the cavity of the abdomen was filled with dark-coloured urine, there was no sign of peritoneal inflammation. (Lancet, Dec. 19, 1846, p. 660.) This accident is liable to occur in females during parturition, owing to the pressure of the child's head; an occurrence which may throw a charge of malapraxis on the medical attendant. He is expected to know the probability of such an accident occurring, and to guard against it, if necessary, by the frequent use of the catheter. In *Reg.* v. *Balsoner* (Liverpool Lent Assizes, 1838), a surgeon was tried on a charge of this kind. It is important to remember, that although rupture of the bladder is commonly attended, at the time of the occurrence, with intense pain, sickness and prostration of strength, yet persons may occasionally retain the power of exerting and moving themselves after the accident.

In punctured and incised wounds of the bladder, the urine is immediately extravasated; but in gun-shot wounds, the extravasation does not commonly take place until the sloughs have separated. Thus, life may be protracted longer in cases of gun-shot than under other wounds of the bladder. Barzellotti relates the case of a medical student, shot through the bladder in a duel, who did not die until the *twentieth day* from the peritonitis which supervened on the extravasation. (Questioni di Med. Leg. t. iii. p. 174.) One instance of a person recovering from a gun-shot wound perforating the bladder, is reported by Mr. Douglas in the Ed. Med. and Surg. Jour., vol. 13. For the discovery of extravasated liquids or blood, in wounds and other injuries to the abdominal viscera, we must look to the cavity of the pelvis, as it is here that, for obvious reasons, such liquids have a tendency to collect.

Wounds of the genital organs.—Wounds of these organs do not often require the attention of a medical jurist: such wounds, whether in the male or female, may, however, prove fatal to life by excessive hæmorrhage. Self-castration or mutilation is not unfrequent among male lunatics and idiots. An inquest was held some time since in London, upon an idiot, who had bled to death from a wound of this description. When timely assistance is rendered a fatal result may be averted. Incised, lacerated, or even contused wounds of the female genitals, may prove fatal by loss of blood, not from the wound involving any large vessel, but from the numerous small vessels which are divided. Two females were in this way murdered in Edinburgh some years since. The wounds were inflicted by razors, and the women bled to death. (See cases by Watson, p. 104.) This crime appears to have been at one time frequent in Scotland. When deeply *incised* wounds are inflicted upon the genital organs of either sex, the fact of their existence in such a situation at once proves wilful and deliberate malice on the part of the assailant. (See case, *ante*, pp. 242, 251.) Accident is wholly out of the question, and suicide is improbable, except in cases of confirmed idiocy and lunacy. Such wounds require to be carefully examined; for the proof of the kind of wound, when fatal, may be tantamount to the proof of murder.

A practitioner may be sometimes required to determine whether wounds affecting the female organs have resulted from accident, have been *self-inflicted*, or inflicted by others with homicidal intention. In June 1842, a woman received a wound in the genitals by a cutting instrument, on the left side, to the extent of one inch and a half in a longitudinal direction. There was a smaller wound on the right side. The accused alleged that the woman had inflicted the injury on herself; and Dr. Easton, of Glasgow, on being required to state his opinion on the question at issue, came to the conclusion: 1. From the regular edges of the wounds, that they had been produced by a clean cutting instrument, and therefore could not have been caused by a fall, excepting the person had fallen upon some sharply cutting projection. 2. If the woman had injured herself by thrusting a knife into the private parts, the situation and direction of the wounds would have been different. There was a want of proof to connect the prisoner with the act, and he was discharged. This is an improbable situation for the self-infliction of wounds with a view to suicide. Some rules which have been elsewhere given (p. 250) may enable a witness to form an opinion when a question of this kind is involved in doubt. (For a case in which such a wound was homicidally inflicted upon a male, see Ann. d'Hyg. 1848, t. 1. p. 443, and for another which led to a trial for the murder of a female, see Med. Gaz. vol. 44. p. 813.)

Contused wounds on the female genitals prove sometimes fatal by the laceration of parts leading to great loss of blood. Several trials for manslaughter have taken place in which this was proved to have been the cause of death. (See the case of *Reg.* v. *Cawley*, Liverpool Winter Assizes, 1847, also a paper by Mr. Barrett, Assoc. Med. Journal, June 28, 1856, p. 538.) There may be such a loss of blood in these cases as to destroy life, although no large blood-vessel is implicated in the injury. A contused wound on the vulva may occasionally present an ambiguous appearance and be mistaken for an incised wound. When the soft parts of the body are struck by a blow or kick, if there is a bony surface beneath, a longitudinal rent may appear as a result of the force being received by the bone. (p. 257.) A blow on the cranium with the fist produced in one instance a rent which was at first mistaken for a cut. A kick on the vulva, or a fall on this part, may produce a similar injury, and unless carefully examined, may lead to the inference that a weapon has been used for its production. Mr. Barrett, in the paper above referred to, has properly directed attention to this subject. A case in which a contused wound of the clitoris proved fatal has been communicated to the Lancet by Mr. Gutteridge. (Oct. 31, 1846, 478.) A woman, æt. 36, received a kick from her husband in the lower part of the abdomen while she was in a stooping posture. She was seen by Mr. Gutteridge in about three-quarters of an hour, and she had then lost from three to four pounds of blood. She was sinking, and expired in a few minutes after his arrival. On inspection there was no injury to the uterus or vagina; the wound was situated at the edge of the vulva, extending from the pubis along the ramus of that bone. It was about an inch long and three-quarters of an inch deep. The left crus clitoridis was crushed throughout its length, so as to exhibit its cavernous structure. From this the fatal bleeding had proceeded. The heart and great vessels contained no blood. The bleeding from such injuries is always likely to be more profuse when the female is pregnant. A case of recovery from a contused wound to the genitals in a pregnant woman, æt. 40, is reported by Dr. M'Clintock. It is stated that there was profuse bleeding from a laceration involving the urinary passage, but under early treatment the woman did well. (Medical Times, May 15, 1847, p. 233.) It is well known that some females are subject to frequent discharges of blood from the genital organs from natural causes. When the bleeding immediately follows a blow, and the woman has not been subject to such a discharge, the fair presumption is that violence was the cause: but when the flow of blood appears only a long time after the alleged violence, of which no traces can be seen, it is most probably due to natural causes. A case of this kind has been communicated to me by Mr. Procter, of York. There was no difficulty in giving an opinion that the flow of blood was *not* due to violence.

It may be alleged in defence that the injuries found on the body were inflicted *after death*, and not while the deceased was living. Kicks or blows on the vulva, if they destroy life at all, cause death by copious effusion of blood. Violence to this part after death would not produce such an effusion as would account for death. There are also other distinguishing characters which have been elsewhere pointed out (see p. 225). A case was tried in Edinburgh, in which this defence was set up; but Dr. Simpson was enabled to say, from his observation of the effects of such violence to a dead body, that the injuries in question could not have been produced after death.

CHAPTER 36.

FRACTURES — PRODUCED BY A BLOW WITH A WEAPON OR BY A FALL — OCCUR IN THE AGED — BRITTLENESS OF THE BONES — FRACTURES CAUSED BY SLIGHT MUSCULAR EXERTION — IN THE LIVING AND DEAD BODY — HAS A BONE EVER BEEN FRACTURED? — QUESTIONS OF SURVIVORSHIP — DISLOCATION FROM VIOLENCE OR NATURAL CAUSES — ACTIONS FOR MALAPRAXIS.

FRACTURES.

FRACTURES of the bones have some important bearings in relation to medical jurisprudence. They may result from falls, blows, or the spontaneous action of muscles.

Causes.—Questions sometimes arise—1, whether a particular fracture was caused by an accidental fall or a blow? and, 2, if by a blow, whether by the use of a weapon or not? It is obvious that the answers must be regulated by the circumstances of each case. In examining a fracture, it is important to determine, if possible, whether a *weapon* has or has not been used; and this may be sometimes known by the state of the parts. It is a common defence on these occasions, to attribute the fracture to an accidental fall. Fractures more readily occur from equal degrees of force in the old, than in the young; and in the young, rather than in the adult; because, it is at the adult period of life that the bones possess their maximum degree of firmness and solidity. The bones of aged persons are sometimes very *brittle*, and slight violence will then produce fracture. This has been regarded as an extenuating circumstance, when the fracture was followed by death. Certain diseases, such as the venereal disease, gout, rheumatism, cancer, scurvy, and rickets, render the bones more fragile; but they are sometimes preternaturally brittle in apparently healthy persons, and this brittleness appears occasionally to be hereditary. (Dub. Hosp. Gaz. Feb. 1846, p. 189.) In such cases, a defence might fairly rest upon an abnormal condition of the bones, provided the violence producing the fracture was slight. Several trials have taken place in which this brittleness of the bones became a subject of inquiry. In a case of fractured skull leading to death from inflammation of the brain, it was proved that the bones of the skull were unusually thin and brittle, and this led to a mitigation of punishment. (*Reg.* v. *Kennedy*, Gloucester Winter Assizes, 1855.)

Spontaneous fractures.— Supposing that there are no appearances of disease, the fracture may be ascribed to spontaneous causes. Thus bones have been fractured by moderate muscular exertion. The olecranon, os calcis, and patella, are particularly exposed to this accident. The long bones are seldom exposed to an accident of this kind; but the os humeri or arm-bone, in a healthy man, has been broken by the simple muscular exertion of throwing a cricket-ball. (Medical Gazette, vol. 16. p. 659.) Mr. May has reported the case of a young lady, who fractured the neck of the scapula or blade-bone, by suddenly throwing a necklace round her neck. (Med. Gaz., Oct. 1842.) In July 1858, a gentleman of about æt. 40 was in the act of bowling at cricket when on delivering the ball he and some bystanders heard distinctly a sharp crack like the breaking of a dry piece of wood. He fell to the ground as if he had been shot. The thigh-bone was found to be fractured, and evidently from muscular exertion only. No person can meet with an accident of this kind without being instantly conscious of it. It is probable that in such cases, if there were an opportunity of examining the bone, it would be found to have undergone some chemical change in its composition, which had rendered it brittle. A case of spontaneous fracture of the femur was brought into Guy's Hospital in Dec. 1846. A healthy man, æt. 33, of temperate habits, was in the act of placing one leg over the other to look at the sole of his foot, when he heard something give way, and the right leg immediately hung down. On examination, it was found that the right thigh-bone had been transversely fractured at the junction of its middle with the lower third. This case is remarkable, inasmuch as spontaneous fractures of the thigh-bones are very rare,— as the man had not suffered from any of those diseases which cause preternatural fragility, and the fracture was not caused by violent muscular exertion. The actual condition of the bone was of course unknown; but it healed readily, and the man left the hospital at the usual period. In fractures arising from this cause there will be no abrasion of the skin, nor any appearance to indicate that a blow has been struck, while the marks of a blow would, of course, remove all idea of the fracture having had a spontaneous origin. Fractures are not *dangerous to life*, unless, when of a compound nature, they occur in old persons, or in those who are debilitated by disease or dissipated habits. They may then cause death by inducing irritative fever, erysipelas, gangrene, tetanus, or delirium tremens.

Fractures in the living or dead body.—It is not always easy to say, whether a fracture has been produced *before or after death.* A fracture produced shortly after death, while the body is warm, and another produced shortly before death, will present similar characters, except, perhaps, that in the former case there would be less blood effused. A fracture caused ten or twelve hours before death, would be indicated by a copious effusion of blood into the surrounding parts and between the fractured edges of the bones, as well as by laceration of the muscles; or if for a longer period before death, there may be the marks of inflammation. Fractures caused several hours after death, are not accompanied by an effusion of blood. A medical witness may be asked, How long did the deceased survive after receiving the fracture? This is a question which can be decided only by an examination of the fractured part. Unless the person has survived eighteen or twenty-four hours, there are commonly no appreciable changes. After this time, lymph is poured out from the surrounding structures. This slowly becomes hard from the deposition of phosphate of lime, and forms what is called "callus." In the process of time, the callus acquires all the hardness of the original bone. The death of a person may take place during these changes, and a medical man may then have to state the period at which the fracture probably happened, in order to connect the violence with the act of a particular person. Unfortunately, we have no satisfactory data, if we except the extreme stages of this process, upon which to ground an opinion. We can say whether a person lived for a long or a short time after receiving a fracture, but to specify the exact time is clearly impossible; since this process of restoration in bone varies according to age, constitution, and many other circumstances. In young persons, bones unite rapidly, in the old slowly; in the diseased and unhealthy, the process of union is slow, and sometimes does not take place at all. According to Villermé, the callus assumes a cartilaginous structure in from sixteen to twenty-five days; and it becomes ossified in a period varying from three weeks to three months. It requires, however, a period of from six to eight months for the callus to acquire all the hardness, firmness, and power of resisting shocks possessed by the original bone. A force applied to a recently united bone will break it through the callus or bond of union, while, after the period stated, the bone will break as readily through any other part. It is generally assumed, that the period required for the union of a simple fracture, is, for the thigh-bone, six weeks; for the tibia (leg), five weeks: for the os humeri (arm), four weeks; and for the ulna and radius (fore-arm), three weeks; for the ribs, about the same period: but cases have been known in which the ribs had not perfectly united in two months, and in some fractures of the other bones, it was found that union had not taken place in four months.

Has a bone ever been fractured?—This question is sometimes put in reference to the *living* subject. It is well known that a bone seldom unites so evenly that the point of ossific union is not indicated by a node or projection. Some bones are so exposed as to be well placed for this examination, as the radius, the clavicle, and tibia,—these being but little covered by skin; in others the detection is difficult. It is impossible for us to say when the fracture took place; it may have been for six months or six years,—as, after the former period, the bone undergoes no perceptible change. These facts are of importance in relation to the *dead* as well as to the living; since they will enable us to answer questions respecting the identity of skeletons found under suspicious circumstances: and here medical evidence may take a wider range, for a fracture in any bone may be discovered, if not by external examination, at least by sawing the bone longitudinally through the suspected broken part, when, should the suspicion be correct, the bony shell will be found thicker and less regular in the situation of the united fracture than in the other parts. So, in such cases, it will be easy to say whether a fracture is recent or of old standing. In the case of *Clarke*, who was murdered many years since by Eugene Aram, the traces of the fracture and indentation of the temporal bone were plainly distinguishable on the exhumation of the skeleton of the deceased *thirteen years* after the perpetration of the murder. The manner in which the murder was committed was confessed by an accomplice, and the medical evidence corroborated this confession. An instance of the utility of this kind of knowledge came out on the trial of a gentleman in India, in 1833, for the murder of a native, *Meer Khan.* There was some reason to suppose that the prisoner had been falsely accused of causing the death of the native. Two witnesses deposed that a few hours before the death of the deceased, the prisoner had struck him several blows on the chest, and had broken his ribs. The alleged murder having taken place some months previously to the trial, a skeleton was produced as being that of the deceased, by one of the persons who had assisted in burying the body. On examining the ribs, the medical witness found that only one rib was broken, and the fractured portions were united by a firm osseous callus. He therefore declared, that the fracture could not have been caused a few hours before death; but that it must have existed for a period of at least eight or twelve days. Hence the account given by the witnesses was rendered improbable; for the prisoner had used no violence to the deceased, except just before his death; the fracture must therefore have taken place from another cause some time previously. The witness much understated the period at which the fracture probably occurred; for ossification only commences in the cartilage about the sixth day, and the specks of bony matter continue to increase from the eighth to the twelfth day; but the union is soft, and some weeks elapse before the callus becomes firm and hard as it is here described to have been.

Locomotion.—With respect to the power of *locomotion* after a fracture, it may be observed, that when the injury is in the arm or in the ribs, unless many of them are broken, a person may move about, although unfitted for struggling or making great exertion. Fractures of the leg generally incapacitate a person from moving except to short distances. See case by Syme, Ed. Med. and Surg. Journal, Oct. 1836; also another in which one bone of the leg was fractured and a power of walking some miles was retained, Amer. J. Med. Sci., Oct. 1845, p. 484. (The reader will find additional information on this subject in the Ann. d'Hyg. 1839, t. 2. p. 241; and 1844, t. 2. p. 146.)

DISLOCATIONS.

Dislocations are not frequent in the old or in those persons whose bones are brittle. They rarely form a subject for medico-legal investigation. A witness is liable to be asked, what degree of force, and acting in which direction, would produce a dislocation,—a question not difficult to answer. They are not dangerous to life, unless of a compound nature, when death may take place from secondary causes. A dislocation which has occurred in the *living body* may be known after death by the laceration of the soft parts in the neighbourhood of the joint, and by the copious effusion and coagulation of blood. [For an account of the appearances presented by a dislocation of the shoulder four days after death, see Med. Gaz. vol. 31. p. 266.] If of old standing, a dislocation would be identified by the cicatrices in surrounding structures. Dislocations may occur from *natural causes*, as from disease and destruction of the ligaments in a joint; also from violent muscular spasm during an epileptic convulsion. Dr. Dymock met with an instance of dislocation of the shoulder forwards during puerperal convulsions. (Ed. Med. and Surg. Journal, April 1843; see also Lancet, April 1845, p. 440.) A power of *locomotion* may exist, except when the injury is in the lower limbs: but it has been observed, that for some time after a dislocation of the hip-joint, considerable power over the limb remains; it is only after a few hours that the limb becomes fixed in one position. Exertion with the dislocated member is in all cases out of the question.

Diagnosis—malapraxis.—There are certain fractures of an obscure kind which closely resemble dislocations. This has been pointed out by Sir A. Cooper, in relation to fractures of the anatomical neck of the os humeri (arm-bone). (Guy's Hosp. Rep. No. 9. p. 272.) This accident might be easily mistaken for a dislocation of the shoulder. (Med. Gaz. vol. 36. p. 38.) In attempting to reduce the bone, the head continually falls back into the axilla. In such a case an action for malapraxis might be brought against a surgeon, and heavy damages recovered. It could only be by a dissection of the part after death that the real nature of the case would be ascertained. It is requisite, therefore, that great caution should be used in giving an opinion. The same observations apply to fractures of the neck of the thigh-bone, although with less force, because this is a more common accident. It is well-known that fractures and dislocations, when cured, are often attended either with some slight *deformity* of the limb, or with some impairment of its functions. This result is occasionally inevitable under the best treatment; but it is commonly set down as a sign of unskilfulness in the medical attendant. An action for malapraxis is instituted, and, in spite of good evidence in his favour, the surgeon is sometimes heavily fined for a result which could not be avoided. There is often great injustice in these proceedings, and the mischief can only be remedied by referring the facts to a competent medical tribunal, which alone should be empowered to decide whether or not unskilfulness had really been shown in the management of a case. The system of allowing each party to select his own medical witnesses invariably leads to a conflict of opinion and evidence.

CHAPTER 37.

GUN-SHOT WOUNDS—THEIR DANGER—ON THE LIVING AND DEAD BODY—WAS THE PIECE FIRED NEAR OR FROM A DISTANCE?—EVIDENCE FROM SEVERAL WOUNDS—THE PROJECTILE NOT DISCOVERED—DEFLECTION OF BALLS—ACCIDENTAL, SUICIDAL, OR HOMICIDAL WOUNDS—POSITION OF THE WOUNDED PERSON WHEN SHOT—WOUNDS FROM SMALL-SHOT—WOUNDS FROM WADDING AND GUNPOWDER—IDENTITY FROM THE FLASH OF POWDER—EXAMINATION OF THE PIECE AND PROJECTILE.

Gun-shot wounds are of the contused kind, but they differ from other wounds in the fact that the vitality of the parts struck by the projectile is destroyed, and this leads ultimately to a process of sloughing. The legal definition of a wound applies here as in other cases, so that, in order to constitute a gun-shot wound within the meaning of the statute, the cutis, or true skin, must be injured. In the *Queen* against *Mortlock* (Cambridge Lent Assizes, 1843), the surgeon deposed that there was a circular wound on the skin, by which it had been deprived of its cuticle, but the true skin was not penetrated. The bullet had struck obliquely at a considerable angle; had it been otherwise, it must have entered the abdomen. The judge said that, as the true skin was not penetrated, there was no wounding within the meaning of the statute.

Their danger.—The medico-legal questions which arise out of gun-shot wounds, are similar to those which have been examined in relation to other wounds. They are *dangerous to life*, especially when they penetrate or traverse any of the great cavities of the body. Death may take place directly either from loss of blood or from shock; although immediate or copious bleeding is not a common character of these injuries. Death from shock is occasionally witnessed. In the case of *Daly*, who was killed by a pistol-bullet in Hornsey Wood, May 1842, it was found, on inspection, that the bullet had traversed the distended stomach at the greater end from behind forwards. The two apertures were about the size of a shilling, and the edges black. There was but little blood effused, and the other viscera were uninjured. The deceased died a few seconds after receiving the wound, obviously from a shock to the nervous system. (Lancet, May 1842.) Indirectly, these wounds are attended with much danger; sloughing generally takes place uniformly throughout the whole of the parts perforated, and inflammation or fatal bleeding may cut short life. If the person survive the first effects, he may die at almost any period from suppurative fever, erysipelas, gangrene, or from the results of operations absolutely required for his treatment. Gun-shot wounds may thus destroy life after long periods of time. Marshal Maison, one of Napoleon's generals, died in Paris in 1840 from the effects of a gun-shot wound received, it is said, forty years before. In gun-shot wounds of a severe kind, the first symptoms by no means indicate the degree of mischief. Thus in the case of Mr. Drummond, who was shot by *M'Naughten*, in January 1843, the symptoms were in the first instance so slight, that the bullet was supposed not to have penetrated the cavity of the abdomen, but to have coursed round the skin. Death took place in a few days, and it was then found that the bullet had completely traversed the abdomen, perforating the diaphragm. Army surgeons have also remarked that slight wounds of the parietes are often insidiously attended with deep-seated injury. Death might in such a case be improperly ascribed to mismanagement, when it may have been really caused by the wound. (See cases by Mr. Alcock, Med. Gaz. vol. 24. p. 850.) It is not easy to mistake a gun-shot wound for any other injury. If the circumstances under which it is produced do not satisfactorily account for its origin, a simple examination will suffice to show its true nature. Sometimes the projectile, or a part of the dress, is found lodged in the wound.

On the living and dead body.—A medical witness may be asked whether the wound was inflicted *before or after death.* It is by no means easy to answer this question, unless the bullet has injured some vessel, when the effusion of blood and the formation of coagula will indicate that the person was living when it was received. In a gun-shot wound on the dead body, no blood is effused unless the bullet happens to strike a large vein.

Was the piece fired near or from a distance?—A gun-shot wound produced by the muzzle of a piece being placed near to the surface of the body, has the following characters:—There may be two apertures, the one of *entrance* and the other of *exit;* but it sometimes happens that the bullet lodges and does not pass out. The edges of the aperture of entrance are torn and lacerated, and appear blackened, as if they had been burnt: this arises from the heat and flame of the gunpowder at the moment of explosion. The skin is often ecchymosed, and is much blackened by the powder:—the clothes covering the body are blackened by the discharge, and sometimes ignited by the flame. If the muzzle of the piece was not in immediate contact with the part struck, the wound is rounded; but if there has been direct contact, the skin, besides being burnt, is torn and much lacerated. The bleeding is usually slight, and when it occurs it is more commonly observed from the orifice of exit than from that of entrance. It should be remarked, that the aperture of entrance is round, only when the bullet strikes point-blank or nearly so. If it should strike obliquely, the orifice will have more or less of an oval or valvular form; and by an observation of this kind we may sometimes determine the relative position of the assailant with respect to a wounded person. Supposing the bullet to have been fired from a moderate distance, but so near as to have had sufficient momentum to traverse the body, then the appearance of the wound will be different. The *orifice of entrance* will be well defined, round or oval, according to the circumstances,—the skin slightly depressed,—the edges presenting a faintly bruised appearance, but the surrounding parts are neither blackened nor burnt, and they do not present any marks of bleeding. In these cases the *orifice of exit* is large, irregular, the edges somewhat everted, and the skin lacerated, but free from all appearances of blackness or burning: it is generally three or four times as large as the entrance-aperture. This is denied by Dr. Malle (Ann. d'Hyg. 1840, t. 1. p. 458), but it appears to me upon insufficient grounds. The orifice of entrance is generally large and irregular when the bullet strikes near the extremity of its range. Under common circumstances, the entrance-aperture may have the appearance of being smaller than the projectile, owing to the elasticity of the living skin. (Ann. d'Hyg. 1839, t. 2. p. 319.) It is the same with the aperture in the dress, when this is formed of an elastic material:—according to Dupuytren, the hole in the dress is always smaller than that made by a bullet in the skin. These points should be remembered in fitting projectiles to wounds which they are supposed to have produced. Useful evidence may be sometimes obtained by a careful examination of the projectile, which, if found, should be preserved by the medical witness for the purpose of identity. When the projectile cannot be found, and there are no marks of burning, or other signs of a near wound on the skin, we must be cautious in expressing an opinion. Mr. Ward has reported a case in which a perforating wound of the skull closely resembled a bullet wound. (Med. Gaz. vol. 44. p. 767.)

Was the deceased shot while running away or when approaching the person who fired?—This question is answered by observing in the case of a traversing wound, in which alone any difficulty can arise, whether the entrance-orifice is situated in front or behind. A trial took place at the Maidstone Assizes, some years since, in which this question was material. (Smith's For. Med., p. 290.)

The question whether a piece was fired *near to or at a distance* from the wounded person, may be of material importance either on a charge of homicide, or of alleged suicide. Two persons may quarrel, one having a loaded weapon in his hand, which he may allege to have been accidentally discharged, and to have killed the deceased. If the allegation be true, we ought to find on the body the marks of a near wound: if, however, it were such that it had been produced from a distance, and, therefore, after the quarrel,—the medical proof of this fact might imply malice, and involve the accused in a charge of murder. The following case occurred in Ireland in 1834:—A tithe-collector was tried for the murder of a man by shooting him. It appeared in evidence that the prisoner, while on duty, was attacked by the deceased and two of his sons, and he drew a pistol to intimidate them. He was dragged off his horse by these parties, and during the scuffle, it is supposed, the pistol was discharged accidentally and inflicted a wound on the deceased, of which he died shortly afterwards. The sons of the deceased swore that the prisoner took a deliberate aim, and fired the pistol at their father when at some distance; and a priest came forward to depose that such was the dying declaration of the deceased. From some doubt of the truth of this story, the body, which had been carelessly inspected in the first instance, was ordered to be disinterred. It was carefully examined by a surgeon, who was enabled to swear positively, that the pistol must have been fired close to the body of the deceased, and not at a distance, since there were the marks of powder and burning on the wrist. Hence it clearly followed that the pistol had been discharged during the scuffle, either by accident or in self-defence. The prisoner was acquitted, and the parties who had appeared as witnesses against him were indicted and convicted of perjury. In the case of *Mr. Pearce*, a surgeon, who was tried at the Central Criminal Court, in 1840, for shooting at his wife, and was found insane, it appeared from the medical evidence that the pistol had been fired so near to the person of the prosecutrix, that her dress was burnt and the skin blistered. Mr. Marshall relates that when stationed at Ceylon with troops, a man, who had but recently joined the regiment, was placed as sentry in a position where he was occasionally fired at by the enemy from the surrounding jungle. The man was one day found severely wounded; the calf of his leg was greatly torn; the whole charge of a musket having passed through it. He attributed the wound to a shot from the enemy: but from the skin of the leg having been completely blackened by charcoal, it was clear that it must have arisen from the discharge of his own musket. He had inflicted this wound upon himself in order to obtain a discharge from the regiment. These examples, then, show that both the dress and skin of a person who has received a gun or pistol-shot wound should be closely examined. The result may be, that the statement given of the mode in which a wound was received, will be entirely disproved. The case of *M. Peytel*, tried in France, in September 1839, furnishes an additional illustration. This gentleman was travelling in a carriage, in company with his wife, and attended by a man-servant. The wife and the man-servant were found dead on the road, and the account given by M. Peytel was, that the servant had discharged a pistol into the carriage and shot his wife, and he had afterwards pursued and killed him. The facts, however, were so suspicious against M. Peytel that he was charged with the double murder. From an examination of the body of the wife, it appeared that there were two pistol-wounds in the face which had most probably been produced by two separate pistols. The prisoner alleged that about nine o'clock at night, when it was dark, he desired the servant to get down and walk in order to relieve the horses. Two minutes afterwards some man, whom he found to be the servant, approached the carriage-door, discharged a pistol at him, and wounded his wife; but the evidence showed that two weapons must have been used, or at least two different discharges made by a person sitting very near to the deceased, so that the muzzles must have almost touched her face, the eyelashes and skin having been much burnt by the powder. These facts, together with other strong circumstances against him, led to the prisoner's conviction. The late Dr. Ollivier, who appeared in the prisoner's favour, considered that the deceased might have been shot by the servant, and that the two wounds might have been produced by one pistol loaded with two bullets; also, that the marks of burning about the face of the deceased might be attributed to the wadding, and, therefore, they afforded no proof that the muzzle of the pistol had, at the time of its discharge, been close to her person. He further contended that the deceased had not died from the wounds. Notwithstanding these ingenious suggestions, there can be no doubt that the prisoner was properly convicted. (See Ann. d'Hyg. 1839, t. 2. p. 339; 1842, t. 1. p. 368.) The amount or degree to which the clothes and body of a person may be burnt by the near discharge of fire-arms has given rise to medico-legal inquiry. A fact of this kind can only be determined by the circumstances of each case. (Ann. d'Hyg. 1860, t. 1. p. 125.)

It has been said that when a bullet is fired near, it commonly traverses the body; and therefore it has been rather hastily assumed, that when there is only one external wound, and the bullet has lodged in the body, this is a proof that the piece has been fired from a distance. This inference is, however, erroneous. A bullet may be fired close to a person, and yet not traverse the body, either from its impulsive force not being sufficiently great, or from its meeting a great resistance in its course. Many cases might be cited to show, that in the near wounds produced by suicides and murderers, the bullets have not always traversed the body (p. 332). In suicide, when the piece is discharged into the mouth, the projectile often lodges in some part of the head.

Evidence from several wounds.—When several wounds are found on a body,—can we determine whether they were produced by one or several different discharges? This question was raised in *Peytel's* case, as there were two wounds on the deceased, and the prisoner alleged that the servant had fired but one pistol. M. Ollivier thought that this might be explained by supposing that there had been two bullets in the pistol:—it was, however, affirmed by some military officers and other witnesses, that these wounds had been produced by separate pistols, a fact which overthrew the defence of the prisoner. (Ann. d'Hyg. 1842, t. 1. p. 368.) It is proper to remark that one ball may sometimes produce several wounds on the body; there will be only one orifice of entrance, but owing to the ball occasionally splitting within the body, and dividing itself into three or four pieces, there may be several orifices of exit. This splitting of a ball has repeatedly occurred when the projectile in its course has encountered an angular surface, or a projecting ridge of bone. Dupuytren met with an instance, in which a ball, after having struck the ridge of the tibia, divided itself into two parts, which traversed the calf of that leg, and penetrated into the calf of the opposite leg. Thus no fewer than five wounds were produced in one instance by a single ball; three of entrance and two of exit. Had this man been found dead, and nothing known concerning him, this singular circumstance would probably have given rise to considerable embarrassment. After a careful examination, a surgeon might have been induced to declare, that this person must have received at least three distinct shots. A similar effect was observed in another case, in which the bullet struck the parietal bone and divided itself into two portions:—one passed out superficially through the integuments, the other penetrated into the brain, and lodged on the tentorium. This fact shows, that the discovery of an exit-aperture does not always prove that the whole of a projectile has passed out,—a matter which may influence a medical opinion as to the result.

Deflection of balls.—When a ball traverses the body, it sometimes happens that the two apertures are opposite to each other, although the ball may not have taken a rectilinear course between them, but have been variously deflected by the subjacent soft parts. This deflection of a ball from a rectilinear course is met with in those cases in which it happens to strike obliquely a curved surface, and it is found that when the ball enters and does not pass out, its course is often circuitous, so that it is not always easy to say in what part of the body it will be found. In 1830, I saw at the Hôtel-Dieu, a boy who had received a gunshot wound in the upper part of the abdomen: the entrance-orifice was plainly situated there, but there was an opening at the back, nearly diametrically opposite, out of which the ball had passed, so that it conveyed the impression that the ball had completely traversed the abdominal cavity. There was, however, no sign of collapse or depression, nor any indication of serious injury; and Dupuytren gave an opinion, which was afterwards verified,—that the ball had not penetrated, but had been deflected beneath the skin, and had taken a circuitous course through the cellular membrane to the back. Many similar facts are recorded. The same deflection may occur even when the piece is discharged close to the body, as in cases of suicide. Mr. Abernethy was once called to examine a man, who had shot himself, as it was supposed, through the head. He found two openings in the scalp, nearly opposite to each other; it was soon perceived, on examination, that the ball had not penetrated the bone, but had followed the curve of the exterior of the skull to its point of exit. The deflection of projectiles may occur not merely when they come in contact with bone, but when they meet skin, muscles, tendons, or membranes, —the ball then takes its course in the spaces between these different structures. A ball which entered at the ankle has been known to make its exit at the knee; and another, which entered at the back of the left shoulder, passed down on the inside of the scapula, and was found below the right ear. This deflection of a ball by slight obstacles has been ascribed partly to the obliquity with which it strikes, and partly to the rotatory motion on its axis which every spherical projectile is considered to have. It does not appear to be much connected with the degree of velocity, for the same deviation has been found to occur when the bullet was fired near or at a distance.

If we can at any time discover two fixed points where a ball has touched a building without being deflected, it will be easy to determine the *situation* from which the piece was discharged. A singular example of this kind is stated by Mr. Watson to have occurred at Ayr in 1831. Several shots had been maliciously fired into a church. Some of the bullets traversed a window, making holes in the glass, and struck against a wall on the other side of the church,—a fact plainly indicated by the marks which they left. A straight line carried from these two points reached a window on the opposite side of the street, from which it was afterwards ascertained the bullets had been fired.

Survivorship.—A witness may be asked—When was the gun-shot wound inflicted, and how long had the wounded party *survived* after receiving it? A gun-shot wound undergoes no change for eight or ten hours after its infliction. Our judgment in reference to these questions may be assisted by observing the parts which are involved, although we cannot always infer from the quantity of blood found near to the body that the bleeding was an immediate consequence of the wound, or that the whole of the blood was effused at once. We cannot, then, always affirm that the deceased could not have moved or exerted himself in some degree, after receiving it. The exertion thus made subsequently to his being wounded, may have actually caused the fatal bleeding.

Suicidal, or Homicidal wounds.—When it is doubtful whether a wound was the result of suicide or homicide, the point may be often settled by paying attention to its situation and direction. *Suicidal* gun-shot wounds are almost always directed to a vital part,— to the heart or to the brain:— they possess those characters which belong to wounds inflicted near to the body: the skin is blackened or burnt, the wound wide and lacerated,—the hand which discharged the weapon often blackened,— and sometimes still grasping the pistol. The ball may or may not have traversed, as this will depend on the momentum which it derives from the charge, and the resistance that it experiences. (See the case of the *Queen* v. *Thomas*, Brecon Lent Assizes, 1845.) The situation in this instance negatived the supposition of suicide. Suicidal gun-shot wounds are seldom situated at the back of the body; therefore the determination of the point of entrance, if the ball has traversed, is of some importance. The direction of these wounds is probably of less moment than their situation, because the projectile is liable to be deflected in the body. In a duel which occurred in Paris, in 1827, one of the parties, a tall man, was killed by a ball which was found to have entered below the right shoulder, and to have taken a direction downwards. In consequence of this, it was thought that he had been shot unfairly by his antagonist, who was short in stature. Breschet and others explained the suspicious course of the wound, by assuming that the ball had struck the under part of the clavicle, and had thence probably been deflected downwards. This question excited considerable attention at the trial of a *Dr. Smith* for the murder of a William Macdonald, at St. Fergus, in Scotland (High Court of Justiciary, Edinburgh, April 1854). It appeared from the evidence that the deceased was found dead in a field belonging to the prisoner, on the morning of Sunday, the 20th November 1853. The body, according to the testimony of eye-witnesses, was lying at full length on its left side in a ditch. The left arm was partly beneath, and the right partly across the body. There was a blackened wound or hole in the cheek, and a little blood on the cheek. A pistol was lying on the ground, according to one witness, about four feet from the head of the deceased. The time at which the deceased died was fixed with tolerable precision at twenty-five minutes before eight o'clock on the evening of the 19th November; and although the prisoner was not seen near the spot, there was evidence that he had made an appointment to meet the deceased that evening, and the testimony of many witnesses showed that he had had an opportunity of being on the spot at the time when the discharge of a pistol had been heard. The defence was, that this was an act of suicide. The pistol could not be identified as belonging to the prisoner; and one witness for the defence positively swore that, six years before, he had sold to the deceased a pistol resembling that found near his body! Upon this statement and upon the failure of the medical evidence to throw any light upon the important question of homicide or suicide, the prisoner was discharged on a verdict of Not Proven. (Med. Times and Gazette, April 22 and May 20, 1854.)

It was proved by the two medical witnesses who gave evidence at the trial, that deceased had died from a pistol-shot, the bullet having penetrated the brain. From the characters of the wound, one thought that the muzzle of the pistol, when discharged, must have been within from three to twelve inches of the face. He admitted that, as an act of suicide, the body might have assumed the position in which it was found, but that the probabilities were against it. The other witness thought that the pistol, when discharged, might have been twelve or thirteen inches from the face; and although a person standing could, in his opinion, have made the wound that appeared on the cheek, yet a suicide would probably have made more sure of his aim, by selecting another position. The only information regarding the wound was, that it was in the right cheek, below the malar prominence; that the opening was blackened, and the nose scorched with gunpowder. It appears that the medical witnesses did not see the body until after the lapse of *two days!* It had in fact been removed from the spot, washed, dressed in grave-clothes, and put into a coffin, before they saw it. (Letter by Dr. Gordon, Med. Times and Gaz., May 20, 1854, p. 525.) Thus the marks of gunpowder on one of the hands, generally found in suicide by pistols, were not seen here; and the removal of the body from the spot placed the medical men in a difficulty, since they could base their opinions only on the statements of ignorant witnesses. There were marks of blood on the ground; but these, it was suggested, might have been accidentally caused during the removal of the body. The situation of the wound, i. e. below the malar prominence in the cheek, is rather unusual for an act of suicide: it was such as a murderer walking by the side of the deceased could have easily selected. The distance at which the pistol was held appears to have been greater than we find in cases of suicide; for had it been close, as it usually is in suicide, there would have been marks of extensive burning and laceration of the soft parts about the wound. The position of the pistol with respect to the body, as described by the witnesses who found it, is inconsistent with the supposition that deceased had thus fallen accidentally after having himself discharged the pistol. There was no motive for suicide, and no reason why, had suicide been contemplated, the deceased should have selected the prisoner's field for perpetrating the act. Deceased had been seen transacting business within half an hour of the time at which he must have died; and it was stated by his friends that they had never seen him with a gun or pistol in his possession, and had never known him to use firearms. Every fact, medical and moral, tended to prove that this was an act of homicide, and not one of suicide: further, there was no mark of struggling or scuffling, and no robbery had been perpetrated. The motive suggested by the prosecution against the prisoner, was based on the fact that he had effected insurances to the amount of about two thousand pounds, in three different offices, upon the life of the deceased, in whose life, however, he had no pecuniary interest. The insurances were for short periods; and it appears to be the practice in the Scotch offices that the policy is not rendered void by the act of suicide. It is important to state, as a supposed motive for the act, that the risk connected with the largest insurance (for one thousand pounds) commenced on the 24th November 1852, and terminated on the 24th November 1853. Only one premium to the amount of about eleven pounds had been paid, and, as it was proved, by the prisoner Smith. The deceased was found dead on the 20th November, i.e. only four days before the date at which the policy of insurance upon his life would have lapsed. The accused had thus the motive, means, and opportunity of committing the crime, but there were no circumstances which could directly connect him with it. The early interference with the body, and the neglect to call for a medical investigation, probably led to the obliteration of parts of the evidence which would have clearly satisfied the jury that this could not have been an act of suicide.

Accidental gun-shot wounds bear the characters of near wounds:—they may touch vital parts, but, if the body has not been disturbed, the presence or absence of design in the infliction of a wound is commonly made apparent by the relative position of the body and the weapon. They frequently arise from persons drawing the charges of guns or pistols with the muzzles pointed towards them, and they are then situated in front:—at other times they are produced by persons pulling towards them through a hedge, or dragging after them, a loaded gun. In the latter case the wound is behind, and it may strongly resemble a homicidal wound, although the circumstances under which the body is found generally suffice to explain the matter. (See Ann. d'Hyg. 1860, t. 1. p. 443.) In the following case of attempted suicide, the characters of the wound somewhat resembled those which are commonly imputed to homicide. In March 1844, a man was brought to Guy's Hospital, with a large ragged gun-shot wound on the right side of the head, behind the angle of the jaw, and between it and the ear. No slugs or bullets could be found; the direction was from behind forwards, and from above downwards. According to this man's statement, the pistol missed fire three times, but he succeeded in discharging it into his mouth at the fourth attempt. He lost a large quantity of blood, but after some time he walked to a table at the distance of five yards, reloaded the pistol, and discharged it at the back of his head in the situation described. Thus, then, there were in this case two wounds, one of them being apparently homicidal in its characters: and there was a power of locomotion after the first wound, in spite of great loss of blood. A gun-shot wound in the mouth or temple would seldom be set down to accident, and yet attempts are occasionally made to ascribe to such wounds an accidental origin. The admission of a near wound in the temple occurring from accident, must depend entirely upon the circumstances proved. (See the case of *Reg.* v. *Tottenham*, Norwich Lent Assizes, 1845.)

Position of the wounded person when shot.—Did the deceased receive the shot while standing, falling, or lying down? Was the piece, when discharged, pointed from the shoulder? These questions can only be answered by reference to the particular circumstances of the case. In general, when a person is shot while standing, and the piece is pointed from the shoulder, the wound is more or less transverse; but due allowance must be made for the deflection of balls after penetration. (The *Queen* v. *Magarity*, Central Criminal Court, July 1841.)

Wounds from small-shot.—Death is sometimes occasioned by small-shot, and here several medico-legal questions present themselves. Small-shot may act in two ways:—1, it either strikes without spreading, in which case the discharge is always near the person, and its action is much more dangerous than that of a single ball, because it produces extensive lacerations; or 2, it strikes after it has spread, and here the discharge must have been distant, and comparatively little mischief is done. Dr. Lachèse ascertained, by many experiments on dead bodies, that in order to produce with small-shot a round opening, somewhat resembling that produced by a bullet, the discharge should take place point-blank at the distance of about ten or twelve inches from the surface of the body. When the distance was from twelve to eighteen inches, the opening made was irregular, and the borders were much lacerated; at thirty-six inches, a central opening was entirely lost, and the surface of the body was covered by shot. The effect after this was found to depend on the distance, the goodness of the gun, and the strength of the charge (Ann. d'Hyg. 1836, p. 386): but the shot is in general much scattered over the surface of the body. From these results we may form an opinion of the distance at which the piece was fired. In the *Queen* v. *Chapman* (Oxford Lent Assizes, 1839), it was proved that the deceased had been killed by small-shot fired from a gun; that the discharge must have taken place very near, as the shot had not been scattered, and the point of the gun must have been below the level of the wound, as the direction was rather upwards. Two medical witnesses were examined, and both agreed that, judging from the direction of the wound, the gun, when fired, could not have been pointed from the shoulder. A similar question was raised in *Reg.* v. *Hull* (Oxford Summer Ass. 1846), and it was decided that the discharge of the gun took place accidentally during a struggle. The case of the *Queen* v. *Kendrew* (York Winter Assizes, 1844) is in this respect of some medico-legal importance. The medical evidence was very satisfactory. It was shown to be highly improbable that deceased could have shot himself with small-shot from a gun, as the shot were scattered, and there was no round opening or mark of burning. It is difficult to conceive that small-shot can, under any circumstances, produce a single entrance-wound, having some appearance of circularity about it, without at the same time singeing or burning the skin or dress.

Admitting the correctness of the inferences drawn by Dr. Lachèse, from the results of his experiments in discharging small-shot at dead bodies placed at different distances, it does not seem probable that a wound from small-shot can, under any circumstances, be mistaken for one produced by a leaden *bullet.* This question, however, arose in a case tried by Parke, B. (*Reg.* v. *Spriggs*, Lewes Lent Assizes, 1854), in which the prisoner was charged, upon his own statement, with having caused the death of his wife by discharging at her a loaded gun. When seen shortly after by the medical witness, deceased was quite dead. There was a "jagged" wound upon her forehead, about an inch above the right eyebrow. The witness described it as a wound which, from its appearance, might have been produced by any blunt instrument, or by a gun fired from a short distance! On further examination it was found that the back part of the head had been driven in (?), and it appeared as though the shot had passed completely through the head and brain, passing out behind in a direction slanting downwards, the wound behind being three inches lower than that in front. He did not see any shot, nor did he open the head to endeavour to find any; but a portion of the skull and hair had been driven into the wound. The learned judge properly suggested that the brain should have been examined, as some shot might have remained there; and this would have shown exactly how the mortal injury was produced. The medical witness was pressed to say whether he was certain the injury had been caused by shot, and not by a bullet. He said he was certain it was by shot, as he had had much experience on bullet wounds in Ireland! Fortunately, there was good evidence to show that one barrel of the prisoner's gun had been discharged, and the undischarged barrel was found loaded with shot. The prisoner was convicted. There appears to have been no indication of burning or singeing of the hair or dress in this case, or the witness would not have suggested that the wound might have been occasioned by a blunt instrument. Considering that there were two penetrating wounds on opposite sides of the head, this was a singular part of the evidence. It is clear that there was one great central wound (the entrance-wound), which, although described as "jagged," appeared difficult to be accounted for, as no shot were scattered or could be found on the skin. Yet this single wound was obviously caused by small-shot. In all similar cases, it would be proper to examine the track of a wound throughout. According to Lachèse's experiments it is probable that the piece was in this case discharged at from twelve to eighteen inches from the surface of the skin.

A discharge of small-shot in contact with the skin or close to it, will, however, produce not a round opening, but a severe lacerated wound. In the case of a gentleman of the Scotch bar (now on the bench), an accidental gun-shot wound in the leg occurred under the following circumstances. He had, during a sporting excursion, lain down on the grass and fallen asleep, the muzzle of his gun being close to the back of the calf of his left leg, and pointing in a slanting direction downwards. By some accident the gun went off, and the shot produced a complete laceration of the whole of the fleshy part of the leg, with no appearance of a round perforation. As might be expected from the closeness of the discharge, the leg of the trousers was much burnt, as well as cut and torn. Although, according to Dr. Lachèse's experiments, a round opening may be produced by small-shot when the piece is fired at the distance of a foot from the body, the above case clearly proves that the shot may be scattered, and an extensively lacerated wound caused, when the muzzle is close to the skin, and the piece is not discharged point-blank. The scattering of the shot, however, in such a case, could not lead to the inference that the discharge had taken place from a distance, because the skin and dress would always present distinct marks of burning.

Small-shot is rarely observed to traverse the body entirely unless discharged so near as to make a clean round opening; but a single pellet reaching the body may destroy life. Two cases have already been mentioned; one in which a young man was killed by a single pellet wounding the fifth intercostal artery; the other, in which a girl was killed by a pellet traversing the orbitar palate and wounding the brain. Such minute wounds might be easily overlooked in an examination of the body. Small-shot, even when wounding only the skin of the back very superficially, has been known to cause death by tetanus.

Wounds from wadding and gunpowder.—It matters not with what the piece is charged,—it is capable, when fired near, of producing a wound which may prove fatal. Thus a gun loaded with wadding, or even with gunpowder only, may cause death. In these cases, an impulsive force is given by the explosion, and the substance becomes a dangerous projectile. The lighter the projectile,—the shorter the distance to which it is carried; but when discharged near to the body, it may produce a fatal penetrating wound. A portion of the dress may be carried into the wound, and lead to death from bleeding: or if the wounded person recover from the first effects, he may subsequently sink under an attack of tetanus or erysipelas. It is unfortunate that so much ignorance prevails on this point: for fatal accidents are continually occurring from persons discharging guns at others in sport,—an act which they think they may perform without danger, because they are not loaded with ball or shot. In the *Queen* v. *Race* (Bury Lent Assizes, March 1840), it was proved that the prisoner had killed the deceased by discharging at him, within a few feet, a gun loaded with powder and paper-wadding. The deceased fell, and died in a few minutes. It was found that the chest was penetrated, and that the wadding had wounded the left auricle of the heart. (See Ann. d'Hyg. 1859, vol. 1. p.421.)

It has been observed, that persons in attempting to commit suicide, have occasionally forgotten to put a bullet into the pistol; nevertheless, the discharge of a piece into the mouth has sufficed, from the effect of the wadding only, to produce a considerable destruction of parts, and to cause a serious loss of blood. Fatal accidents have frequently taken place from the discharge of wadding from cannon during reviews. It is not easy to say at what distance a weapon thus charged with wadding and powder would cease to produce mischief, since this must depend on the impulsive force given by the powder, and on the size of the piece. Dr. Lachèse has ascertained by experiment, that a piece charged with gunpowder is capable of producing a penetrating wound somewhat resembling that caused by small-shot, when the piece is large, strongly charged, and fired within six inches of the surface of the body. (Ann. d'Hyg. 1836, p. 368.) This arises from a portion of the powder always escaping combustion at the time of discharge, and each grain then acts like a pellet of small-shot. Under any circumstances, a discharge of powder only, contuses the skin, producing ecchymosis, and often lacerating it, if the piece be fired near. The dress is burnt and the skin scorched from the globe of flame formed by the combustion of the powder; many particles of gunpowder may be actually driven into the true skin. All the substances here spoken of are considered to be projectiles; and the weapons are held in law to be loaded arms, so long as they are capable of producing bodily injury at the distance from which the piece containing them is discharged. It may therefore become a question as to the distance at which these light projectiles cease to be harmless. The answer must be governed by circumstances; but it will in all cases materially depend on the strength of the charge. In *Reg.* v. *Collier* (Abingdon Lent Assizes, 1844), the prisoner was charged with firing a gun loaded with small-shot at the prosecutor, with intent to do grievous bodily harm. It appeared that the gun was deliberately pointed at the prosecutor, who was then at a distance of from seventy to eighty yards from the prisoner. The shot, which was very small, had marked the clothes, but had not penetrated the skin or inflicted any wound. The defence was, that, from the slight injury done, the prisoner merely intended to frighten the prosecutor, and not to do him any bodily harm. He was found guilty of a common assault. The question was here a delicate one, for had the prosecutor been a few yards nearer, and the pellets touched an exposed part of his body, the result might have been serious. One pellet has destroyed life (p. 387). A case occurred, in the United States, involving the question, as to the distance at which a pistol *not* loaded with ball, would suffice to produce a serious wound. A boy, in play, discharged a pistol at a companion, producing on the fleshy part of the left hip a wound one inch in diameter and four inches in depth. The skin was destroyed, and the muscles presented a blackened lacerated mass. There was no ball in the pistol; but it is not certain whether there was wadding. Death took place from tetanus on the seventh day; and on examination, no wadding was found in the wound. There were, however, grains of gunpowder, with which the wound was blackened throughout its whole extent. At the inquest the witnesses differed respecting the distance at which the pistol was held when the wound was inflicted. Some said one foot; others two or three yards. The deceased had stated his belief that the pistol almost touched him; and, judging by the state of the wounded parts, this was probably the truth. Dr. Swift contended that the wound had been produced by gunpowder only, without wadding. He performed some experiments with the pistol used by the prisoner, but loaded with gunpowder and *wadding,* in order to determine the effect of discharges at different distances. At twelve inches distance from a body, he found that the clothes were lacerated and the skin abraded, but the wadding did not penetrate; at six inches, the clothes were lacerated, and the wadding penetrated to the depth of half an inch; at two inches, the wound produced, which was two inches deep, was ragged and blackened; at one and a half inch from the chest, the wadding passed into the cavity between the ribs, and in a second experiment it carried away a portion of a rib. (Med. Gaz. vol. 40, p. 734.) These results confirm those obtained by Dr. Lachèse (p. 388.).

Identity from the flash of gunpowder.—Among the singular questions which have arisen out of this subject, is the following:—Whether a person who fires a gun or pistol at another during a dark night, can be identified by means of the light produced in the discharge? This question was first referred to the class of Physical Sciences in France, in 1809, and they answered it in the negative. A case tending to show that their decision was erroneous, was subsequently reported by Foderé. A woman positively swore that she saw the face of a person, who fired at another during the night, surrounded by a kind of glory, and that she was thereby enabled to identify the accused. This statement was confirmed by the deposition of the wounded party. Desgranges, of Lyons, performed many experiments on this subject; and he concluded that on a very dark night, and in the absence of every other source of light, the person who fired the gun might be identified within a moderate distance. If the flash were very strong, the smoke very dense, and the distance great, the person firing the piece could not be identified. The question was raised in this country, in the *Queen* v. *White*, at the Croydon Autumn Assizes, 1839. A gentleman was shot at, while driving home in his gig during a dark night; he was wounded in the elbow. When he observed the flash of the gun, he saw that the piece was levelled towards him, and the light of the flash enabled him to recognize at once the features of the accused:—in cross-examination he said he was quite sure he could see him, and that he was not mistaken as to his identity. The accused was skilfully defended, and he was acquitted. Evidence of this kind has, however, been received in an English Court of Law. A case is quoted by Paris and Fonblanque (*Rex* v. *Haines*), in which some police-officers were shot at by a highwayman during a dark night. One of the officers stated that he could distinctly see, from the flash of the pistol, that the robber rode a dark-brown horse of a remarkable shape in the head and shoulders; and that he had since identified the horse at a stable in London. He also perceived, by the same flash of light, that the person had on a rough brown great coat. This evidence was considered to be satisfactory.

From the information which I have been able to collect on this point, it appears to me there can be no doubt that an assailant may be thus occasionally identified. It is widely different, however, in respect to the following case referred to by Müller, in his Physiology; namely, where a man declared that he recognized a robber through the light produced by a blow on his eye in the dark! As Müller observes, this is a clear impossibility; because the flashes thus perceived are unattended with the emission of light, and therefore can never be visible to any other person than the subject of them, and it is not possible that they can ever make other objects visible. [For some remarks on this subject by Dr. Schilbaeh, see Henke's Zeitschrift der S.A. 1842, vol. 1, p. 197.] Dr. Krügelstein has lately opposed the inference deduced by Müller, and has supported his views by cases, which, however, do not appear to me to be satisfactory. (Henke's Zeitschrift der S. A. 1845, vol. 3, p. 172.)

Chemical examination of fire-arms.—An attempt has been made by French medical jurists, to determine for how long a period a gun or a pistol found lying near a dead body may have been discharged; but it is out of our power to lay down any precise rules on such a subject. All that we can say is, a quantity of sulphuret of potassium, mixed with charcoal, is left adhering to the barrel of the piece, when *recently* discharged; and this is indicated by its forming a strong alkaline solution with water, evolving an odour of sulphuretted hydrogen, and giving a deep brown precipitate with a solution of acetate of lead. After some hours or days, according to the degree of exposure to air and moisture, the saline residue becomes converted to sulphate of potash, forming a neutral solution with water, and giving a white precipitate with acetate of lead. If a considerable time has elapsed since the piece was discharged, oxide of iron, with traces of sulphate may be found. (See Ann. d'Hyg. 1834, p. 454; 1839, p. 197; 1842, p. 368.) This subject has excited some attention on certain trials which have taken place in France in reference to the death of *M. Dujarrier*. It was considered here of some importance to determine whether, by the mere discharge of powder, such a deposit of charcoal or powder took place at the mouth of the pistol, as to soil the finger when introduced *three hours* after the alleged discharge. M. Boutigny conducted the investigation, and found in his experiments that the finger was not blackened under the circumstances. He considers that sulphate and carbonate of potash are formed, and that the charcoal is entirely consumed. The facts proved at the trial were, however, adverse to the view thus taken; and it really appears that this most elaborate inquiry, involving physics, chemistry, and mathematics, might have been spared, on the simple ground that the result produced by a discharge of powder in the manner supposed, must depend on the quantity of powder employed (its perfect or imperfect combustion), and the proportion of charcoal contained in it! The elements for solving this pyrotechnic question must therefore in most, if not in all cases, be wanting. (Ann. d'Hygiène, 1848, vol. 1, p. 392.)

Projectiles.—In the case of *Rush*, who was tried and convicted of the murder of *Mr. Jermy*, by a remarkable train of circumstantial evidence (Norwich Lent Assizes, 1849), it was proved that the projectiles removed from the body of the deceased consisted of irregular pieces of lead (slugs). Similar masses were taken from the body of the son, who was killed at the same time. They were described by the medical witness as being angular, and quite unlike the shot used in killing game. Each piece weighed from eleven to thirteen grains, and there were fifteen pieces in all. As the learned judge remarked, this demonstrated that the two acts of murder were committed by the same person, or by this person acting in concert with others. In the *Queen* v. *Lloyd* (Shrewsbury Lent Assizes, 1854), it was proved that deceased had been killed by the discharge of a gun through a window. He was struck on the head by about thirty shots, one of which had penetrated the brain and caused death. The assailant was not seen, but the charge was brought home to him by numerous circumstances: among others, by the discovery, in one of his pockets, of shot of the same sizes as those removed from the head of deceased (Nos. 3 and 4). The surgeon had very properly removed and preserved the shot, so that they were afterwards available as evidence against the prisoner. With respect to the evidence derivable from wadding found in gun-shot wounds, see page 270.

The chemical analysis of a projectile may be occasionally necessary. A common bullet is entirely formed of lead. Cast bullets are commonly found to have a void space in the interior when cut through the centre, owing to the exterior cooling more rapidly than the interior, and to the greater bulk of the metal when in the liquid state. In large bullets this cavity is frequently of the size of a barleycorn. Bullets obtained by compression have no such space, and are of greater specific gravity. Small-shot consist of lead with a minute fractional portion of arsenic ($\frac{1}{200}$th part). If the arsenic is in large proportion the shot is lenticular—if absent, or in small proportion, pyriform (Ure). In the case of *Rush*, type-metal was found in the house. This consists of lead with one-fourth part antimony, the latter being left by digestion in nitric acid. It was, therefore, considered advisable to examine the slugs chemically, and they were found to consist chiefly of lead, and to contain no antimony.

CHAPTER 38.

BURNS AND SCALDS—CIRCUMSTANCES WHICH RENDER THEM DANGEROUS TO LIFE—DID THE BURNING TAKE PLACE BEFORE OR AFTER DEATH?—EXPERIMENTS ON THE DEAD BODY—VESICATION AND LINE OF REDNESS—PRESENCE OF SEVERAL BURNS—WOUNDS CAUSED BY FIRE—HUMAN OR SPONTANEOUS COMBUSTION—HOMICIDAL MISTAKEN FOR SPONTANEOUS COMBUSTION—TIME REQUIRED FOR THE BURNING OF A DEAD BODY—BURNS BY CORROSIVE LIQUIDS.

BURNS AND SCALDS.

A *Burn* is an injury produced by the application of a heated substance to the surface of the body; while a *Scald* results from the application of a liquid at or near its boiling point, under the same circumstances. There seems to be no real distinction between a burn and a scald in reference to the effects produced on the body:—the injury resulting from boiling mercury or melted lead might take either appellation. Nevertheless, as a matter of medical evidence, it may be important to state whether the injury found on a living or dead body was caused by such a liquid as boiling water, or by a heated solid. If the former, the injury might be ascribed to accident: if the latter, to criminal design. A scald produced by boiling water would be indicated by a sodden state of the skin and flesh, but there would be no destruction of substance. In a burn by a heated solid, the parts may be more or less destroyed, or even charred: the cuticle may be found blackened, dry, almost of a horny consistency, and presenting a shrivelled appearance. This destruction would only apply to scalds from water. A scald from melted lead could not be distinguished from a burn produced by a solid heated to the same temperature. Some of the oils boil at 500°, and produce, by contact with the skin, burns as severe as those caused by melted metals. Burns from flame such as that of gas are indicated by extensive scorching of the skin, while burns from gunpowder are known not only by the scorching, but by the small particles of unburnt carbon which are imbedded in the skin.

Action of melted metals.—A singular case in which an attempt on life was made by pouring a melted metal into the ear, occurred to M. Boys de Loury. The mother of an idiot, aged twenty-five, wishing to get rid of him, adopted the plan of pouring melted pewter into his right ear while he was lying asleep. Great pain and violent inflammation followed, but the young man recovered. The mother then alleged that he had himself poured the melted metal into his ear. At a judicial investigation, M. Boys de Loury was required to say whether such an act was likely to occasion death, and if so, how it happened that the party had in this instance recovered. The alloy was formed of seven parts of tin and three of lead, and the melting point of such an alloy would be about 340°. M. de Loury stated that such an act might lead to death by causing inflammation and caries of the internal ear extending to the brain. The recovery of the youth was owing to the mischief which followed having been comparatively slight. In performing some experiments on the dead body, he found that it was difficult to fill the ear-passage with such an alloy, in consequence of the sudden expansion of the air caused by the high temperature. (Ann. d'Hyg. 1847, vol. 2, p. 424.)

Various degrees of burns.—Dupuytren has divided burns into six degrees, which are commonly recognized by medical jurists.

1. The heat produces a simple inflammation of the skin without vesication. The skin is red, but the redness disappears on pressure: there is slight and superficial swelling, with severe pain, relieved by the contact of cold substances. The inflammation subsides after a few hours, and the skin resumes its natural condition:—or it may continue for several days, and the cuticle then peels off.

2. There is a severe inflammation of the skin, and the cuticle is raised into blisters containing a yellow-coloured serum. This kind of injury is generally the result of the action of boiling liquids. Some blisters are commonly formed *immediately*; others are produced during a period of twenty-four hours, and those which are already formed become enlarged. Suppuration takes place if the cuticle is removed, and the person survives for a period sufficiently long. As the cutis or true skin is not

destroyed by this degree of burn, there is no mark or cicatrix to indicate its past existence.

3. The superficial part of the cutis is destroyed. The burn appears in the form of yellow or brown patches, insensible when gently touched, but giving pain when strongly pressed. An inflammatory redness, accompanied by vesication or blistering, is perceived in the healthy portion of skin around the eschars. A white and shining cicatrix, without contraction of parts, remains after healing. This degree of injury is commonly observed in burns from gunpowder, and the part which was the seat of the burn is frequently stained black, when the particles of gunpowder have not been removed soon after the accident.

4. The skin is disorganized as far as the subcutaneous cellular tissue. There are firm and thick eschars, which are quite insensible. If the burn has arisen from a boiling liquid, the eschars are soft and of a yellowish colour; if from a red-hot solid, they are firm, hard, of a brown colour—sometimes black. The skin around appears shrivelled and puckered towards the eschar, which is depressed below the cutaneous surface. The surrounding integuments present a high degree of inflammation, and vesications appear. From the fourth to the sixth day, the eschar falls off, leaving an ulcerated surface, which heals slowly, and is always indicated by a cicatrix.

5. In the fifth degree, the whole of the layers of the skin, the cellular membrane, and a portion of the muscles beneath, are converted into an eschar. The appearances are similar to those of the fourth degree, but in a more aggravated form.

6. The burnt part is completely carbonized. If the individual survives, violent inflammation is set up in the subjacent tissues and organs.

Neither a burn nor a scald appears to be considered as a *wound* in law; but in the statute of wounding they are included among bodily injuries dangerous to life. (1 Vict. c. 85, sec. 2.) Burns and scalds are dangerous to life in proportion to the extent of surface which they cover, as well as the depth to which they extend. The extent of surface involved in a superficial burn, as a result of exposure to flame, is of greater importance than the entire destruction of a small part of the body through an intensely heated solid. When the burn is extensive, death may ensue either from the intensity of the pain produced, or from a sympathetic shock to the nervous system. Death takes place rapidly from burns in children and nervous females: but in adults and old persons, there is a better chance of recovery.

Appearances.—When death has been caused by intense pain, no changes have been detected in the dead body: but under other circumstances, it has been found on inspection that there were patches of redness on the bronchial mucous membrane, as well as on that of the alimentary canal. The brain has been found gorged, and the ventricles have contained an abundance of serosity. The serous liquids of the pericardium and pleura have also been in larger quantity than natural. In short, besides congestion, there is generally abundant serous effusion in one of the three great cavities, especially in the cranium. This arises from the sudden reflux of blood into the interior. (See case by Mr. Long, Med. Gaz. vol. 25, p. 743; also, by Mr. Erichsen, vol. 31, p. 551.) In a case in which a woman died on the thirteenth day from a superficial burn involving the skin of the lower part of her body,—the stomach was found inflamed at its greater extremity, and the duodenum at its lower portion —the mucous folds of the intestines having a scarlet colour. The other intestines as far as the cœcum were also more or less inflamed. (Amer. Jour. Med. Sciences, Jan. 1861, p. 137.) If the person survive the first effects, he may die from inflammation, suppuration, gangrene, irritation, or fever, or he may be worn out by exhaustion. In this respect, burns of the 4th, 5th, and 6th degrees are especially dangerous to life; and it would be unsafe to give an early opinion, as inflammation of deep-seated viscera only appears after several days.

Stupor from burns.—In some instances, especially in children, stupor and insensibility have supervened, owing to a sympathy with the brain; and these symptoms have been followed by coma and death. If, under these circumstances, opium has been given to the patient as a sedative, the stupor resulting from the burn may be attributed to the effects of the drug; and should the person die, the practitioner may find himself involved in a charge of malapraxis. It may be alleged, as in the following case related by Mr. Abernethy, that the person was poisoned by opium. A medical man was charged with the manslaughter of a child by giving to it an overdose of opium, while it was labouring under the effects of a severe scald. Mr. Abernethy stated in his evidence, which was given in favour of the practitioner, that he thought the exhibition of opium very proper:— that the quantity given, eight drops of tincture of opium immediately after the accident, and ten drops two hours afterwards, was not an overdose for a child (the age is not stated). The circumstance of the child continuing to sleep until it died, after the exhibition of the opium, was no proof that it had been poisoned. This sleep was nothing more than the torpor into which it had been plunged by the accident. The surgeon was acquitted. Notwithstanding the favourable opinion expressed of this plan of treatment, it would be advisable to avoid the use of opium on these occasions in respect to infants and children. Life is readily destroyed in young subjects by the smallest doses of this drug (see p. 186); and there are no satisfactory means of distinguishing the comatose symptoms produced by a burn or scald from those produced by an overdose of opium.

Did the burning take place before or after death? Vesication.—The production of *vesication* or of *blisters* containing serum, is commonly regarded as an essential character of a burn which has been produced during life, but it is not a necessary or invariable effect of a burn on the living body. Vesication is especially seen in scalds, or in those cases in which the skin has been burnt by flame or by the ignition of the clothes, provided the cuticle has not been destroyed. It is not so commonly observed in burns produced by intensely heated solids. In vesication, the cuticle is raised from the true skin beneath, and is converted into one or more blisters containing serum, while the skin around is of a deep-red colour. It is uncertain as to the time at which it appears; it may be produced in a *few minutes*, or sometimes not for several hours: thus, death may take place before vesication occurs; and the non-discovery of this condition does not warrant the opinion that the burn could not have taken place during life. If the cuticle is removed from a vesicated part of the living body, the skin beneath will become intensely reddened; but if the cuticle is stripped off in a dead subject, the skin will become hard, dry, and of a horny-yellow colour; it does not acquire the intense scarlet injection which is acquired by the living skin when vesicated and exposed.

Vesication as an effect of dry heat.—There have been conflicting opinions whether the presence of blisters (vesication) on a dead body should be taken as evidence of burning during life. The following may be taken as a summary of the facts hitherto ascertained. Dr. Christison, on one occasion, had an opportunity of trying experiments on the effects of dry heat on the same body before and after death: this was the case of a young man who had poisoned himself with opium. While he was lying in a hopeless state of coma, four hours before death, a hot iron was held on the outside of the hip-joint; and half an hour after death, a red-hot poker was applied to three places on the inside of the arm. Vesication followed the burns in both instances; but those caused during life contained serum, and those which were formed after death, *air*. In another experiment, a cauterizing iron produced no blisters on a leg, half an hour after amputation; but vesications, containing air, were formed, when in another case the iron was applied ten minutes after amputation. On the whole, Dr. Christison thinks that a vesication containing serum, indicates a burn during life, and one containing air, a burn after death. I have performed some experiments on the bodies of infants eighteen and twenty hours after death, both with boiling water and heated solids: but in no case have I observed any kind of vesication to follow at that period. The skin was shrivelled, and was partly destroyed by the heat, but there were no blisters produced. (See case by M. Ollivier, Ann. d'Hyg. 1843, vol. 1, p. 383.) Under certain morbid states, blisters containing serum may be produced in the dead body, even twenty-four hours after death. M. Leuret observed, that this took place in an anasarcous subject, in the vicinity of which a heated brazier had been placed. The cuticle was hardened, then raised and blistered; and the blister contained an abundance of reddish-coloured serum. In repeating this experiment on other dead bodies not infiltrated, it was observed that no vesications containing serum were produced. (Ann. d'Hyg. 1835, vol. 2, p. 387.) M. Champouillon has repeated the experiments of M. Leuret on anasarcous bodies, and he finds that blisters may be produced in these cases at almost any period after death. Thus, they occurred when heat was applied to the anasarcous subject recently dead,—to another when in a state of cadaveric rigidity, and to a third when putrefaction had commenced. The blisters do not appear immediately,—the time which he found requisite for their production varied from two to six hours. The serum effused beneath the raised cuticle was rarely tinged with blood. (Ann. d'Hyg. 1846, vol. 1, p. 421.) These experiments only confirm the results obtained by M. Leuret; they add nothing to our knowledge of the subject. The conclusion to be drawn from them is, that in the examination of *burns* on the body of a person affected with anasarca, it is necessary to be cautious in expressing an opinion. In such cases it would not be possible, from the existence of mere vesication, to say whether the burn took place before or after death.

The late Dr. Wright, of Birmingham, has published the results of some experiments on burning after death, from which he infers that the production of a *serous* blister in the dead body is not dependent on the presence of serum in the cellular tissue (anasarca), but upon the amount of (latent) organic life remaining in the body. He states that he has produced a serous blister in a dead body more than a dozen times,—twice within half an hour, and once within fifteen minutes after death; and in amputated limbs he has produced them in from half a minute to four minutes and a half after amputation. The only favourable opportunity which occurred to him for producing, after death, a serous blister, was in the person of a female thirty years of age, who died suffocated from acute congestion of the lungs. She was slightly anasarcous. *Three hours and a half* after death, when the body was quite warm, and the joints were flexible, a spirit-lamp flame was applied to the lower and back part of the left leg. After the lapse of an hour, blisters had been formed and were filled with serum of a pale straw colour: one contained two and the other three drachms. Ten and fifteen hours after death, when the body had become cold and rigid, the flame produced only *gaseous* blisters. (Pathological Researches on Vital and Post-mortem Burning, 1850.)

Vesication as a result of scalding in the dead body.— Dr. Christison found that when boiling water was poured upon a dead body *ten minutes* after death, the skin was simply ruffled and shrivelled; but the cuticle was not raised into a blister. The same effects were produced so long as the body retained its warmth. Accident has enabled me to state the result within a shorter period than that above-mentioned. The body of a drowned man, within a few minutes of the accident, was removed and placed in a warm (hot?) bath. It was found impossible to resuscitate him, but owing to the great heat of the water, portions of the cuticle came off, when the body was removed. On inspection there were several vesications *filled with bloody serum* over a considerable portion of the skin, especially of the extremities. There was no anasarca here to account for their production; and the fact of their occurrence appears to bear out the view of Dr. Wright, that the production of a *serous* blister on the dead body depends on the amount of latent organic life remaining in the body. The man was pulseless, and to all appearance *dead*, when placed in the hot bath; hence the effects of *hot liquids* on the living and the recently dead body, so far as the production of vesication is concerned, are proved by this case to be similar. Dr. Chambert has lately published the results of numerous experiments on the effects of burns on the living and dead body. These have been made on the bodies of persons, from the moment of death until twenty hours after dissolution, and some were performed before death. The general results of his researches are: that vesications, or blisters, may be produced by burns both on the living and dead body; that they are produced at a lower temperature in the living than in the dead; that in the living a burn produces great capillary congestion, with the effusion of a mixed serum in the blisters, and that this serum when heated, or treated with nitric acid, sets into a nearly solid coagulum. The blisters produced in a dead body, even a few minutes after death, contain a thin watery serum, which is only rendered opaline or milky by heat and the action of nitric acid. (Ann. d'Hyg. 1859, vol. 1, p. 342.)

A line of redness.— In burns, especially in those produced by red-hot solids, other effects besides vesication follow. The edge of the skin immediately around the part burnt is commonly of a dead white; and close to this is a *deep red line*, gradually shaded off into the surrounding skin, which is reddened. The diffused redness is removable by pressure, and disappears with life; the red line here referred to, however, is not removable by pressure, and is persistent after death. This line of redness is not always met with in severe burns; and when a person survives one or two days, its production appears to depend upon a power of reaction in the system. Thus, then, its absence furnishes no proof of the burn having been produced after death; for it is not a necessary accompaniment of a burn during life. Dr. Christison has endeavoured to determine by experiment whether this line of redness could be produced by applying a heated solid to a dead subject. He found that when the person had been dead only *ten minutes*, no such effect was produced. In repeating his experiments on dead subjects many hours after death, I have found that no line of redness ever presented itself; so that its discovery in a dead body burnt, would appear to indicate either that the burning took place during life, or within ten minutes after death,—most probably the former. M. Champouillon takes exception to the inference derivable from these experiments. He says that he has caused the production of a line of redness by the application of heat to the dead body, and that it is a uniform accompaniment of the formation of blisters in the dead. He admits that it is in this case a mere capillary infiltration, quite superficial, and surrounding the margin of the blister, while in the red line produced during life, the tissues of the skin are deeply injected, and it is evidently the result of vital reaction. (See Ann. d'Hyg. vol. 1, p. 442.) It would appear that he has only remarked this condition in dead anasarcous bodies, in which vesications had been produced, and it is obvious from the description, that he is referring to a slight congestion of the vessels, occasioned probably by the stagnation of the fluid portion of the blood in the superficial capillaries. It is altogether distinct from the line of redness described by Dr. Christison as a frequent consequence of severe burns. In the case of *Mr. Westwood* (June 1839), the fact of certain burns on the body having been produced during life, was determined by Mr. French, from an observation of this sign. The deceased was found dead, with his skull extensively fractured, his throat cut, and his body burnt in various places. Mr. French, who gave evidence on this occasion, remarked, that the burns were surrounded by a line of redness:—that they were probably produced about the same time as the other injuries, but certainly while there was some vital action in the system. When, however, vesication and a line of redness are absent, we have no medical data on which to found an opinion,—whether the burn was caused before or after death. Dr. Wright considered that in a low state of vitality a line of redness might not be produced by a severe burn on the living body, and that more certain reliance may be placed on the red marks found beneath the blisters and crusts of vital burns. These latter were well marked when he found the line of redness itself indistinct. (Op. cit. p. 25.) The recent researches of Dr. Chambert confirm this view. In a burn on a living person, if the skin has not been entirely charred and destroyed, the cutis will present a dotted or pointed redness,— these dots or points corresponding to the sudiparous and hair-follicles. After complete death, the burn does not produce any such effect; the cutis is of a dead-white on its surface and its substance. In one experiment performed ten minutes after death, there was no redness of the cutis, either beneath the blisters or in the surrounding parts. (Ann. d'Hyg. vol. 1, p. 1859, 368.) This reddened or congested state of the bare skin is more constant than any other appearance, and forms at present the best criterion of the infliction of a burn on the living body. The medico-legal facts connected with burns on the living and the dead, underwent a minute scrutiny in a remarkable case of alleged matricide at Bridgenorth. (*Reg.* v. *Newton*, Shrewsbury Lent and Summer Assizes, 1849.)

When *several burns* are found on a dead body, it may be a question whether they were all produced at the same time. This is a point which can be determined only by observing whether any of them present signs of gangrenous separation, of suppuration, granulation, or other changes that take place in a living body after accidents of this kind. The witness may be asked, how long did the deceased survive the burn? A person may die in a few minutes or live some hours after receiving a most extensive burn; and yet there will be no change in the part burnt, to indicate when death actually took place. There may have been no time for inflammation or its consequences to become established. Suppuration generally follows vesication, and in severe cases it may occur on the second or third day; but often not until a later period. In regard to gangrene, this takes place when the vitality of a part burned is destroyed. The time of its occurrence is uncertain, but it sometimes very speedily follows the accident.

After murder has been perpetrated, it is not uncommon for a criminal to attempt to dispose of the body by burning it. This occurred in the case of Mr. Paas (*King* v. *Cook*), likewise in the case of the *Queen* v. *Good*, and in another case at Leeds (Jan. 1843), where a mutilated body was found floating in a river with marks of burning about it. In general, the body is not burnt until all signs of life have disappeared; we shall therefore meet, in such cases, with nothing but the charring of dead flesh, so that no difficulty can exist in forming an opinion. When the burning is partial, and has probably taken place from a wilful ignition of the clothes, at or about the time of death, some caution is required in expressing an opinion, since marks of vesication and a line of redness are not always present in burns during life. It is by no means unusual, however, to find it stated in evidence, that blisters are a constant accompaniment of a burn in the living body! In the *Queen* v. *Taylor* (York Lent Assizes, 1842), the deceased was found dead with marks of strangulation on her neck, and her clothes were much burnt from her waist to the knees. She was lying across the hearth,—the body was burnt as well as the upper and lower extremities and the neck; in the opinion of the medical witness, the burn on the neck could not have been produced by the fire extending from the other parts of the body. In cross-examination he stated that the burns must have occurred after death: they could not have taken place before, nor at the time of death, because there was no vesication, and he had never seen a burn on a living person which was not followed by blistering! The prisoner was convicted, his counsel having failed to prove or render it probable that death was caused, as alleged, by accidental burning. The reader will find some remarks on the burning of the living and dead body, in the report of the trial of Dr. Webster for the murder of Dr. Parkman. (See Report by Dr. Stone, Boston, 1850.)

Wounds caused by fire.—On the discovery of wounds on a body burnt by fire, it is necessary they should be closely examined, in order that a witness may be enabled to say whether they have been caused by cutting or other instruments, *before* death by burning, or whether they are not simple mechanical results of the effects of fire on the skin. Mr. Curling has communicated to me a case which will show the necessity for this inquiry. A boy, two years of age, was brought to the London Hospital, Nov. 11th, 1840, so severely burnt on the face, neck, abdomen and extremities, that he survived the accident only three quarters of an hour. It appeared that the stepmother, who had charge of the child, left him at home locked up in a room where there was a fire, while she went out. Some of the neighbours shortly afterwards hearing screams proceeding from the room, broke open the door, and discovered the child enveloped in flames, and its clothes on fire. The flames were immediately extinguished, and the boy was brought to the hospital. Suspicion of unfair treatment having been excited by the appearance of wounds about the knees which were observed as soon as the child was admitted, and by the reported neglect and ill-usage of the child by the stepmother, the coroner directed an inspection to be made. The body was plump and well-formed. The skin in the burnt parts was denuded of cuticle and converted into a deep yellowish or blackish dry mass, which was very tense, hard, and easily torn. There were gaping wounds on both knees. On the right side, a fissure in the skin commenced about the middle of the thigh, and proceeded for two inches and three-quarters to the inside of the patella, where it became somewhat jagged, and making a sudden turn inwards passed to the extent of two inches towards the back of the joint. A transverse laceration of the skin, three-quarters of an inch in length, was observed on the front of the left thigh a little above the left knee; and another, which was also transverse and measured an inch and a half, was situated below, on the inner side of the joint. These fissures in the charred skin were all about three lines in width and two in depth, and exposed the adipose tissue beneath, which was white, and free from all appearance of effusion of blood. The edges of these fissures were not uneven, but they did not present the clean and smooth appearance usually observed in incised wounds. The vessels on the surface of the brain were full of blood, and the cortical structure appeared dark-coloured. The lungs were congested, but the heart contained little blood. The mucous membrane of the stomach presented a slight pinkish hue, but that of the intestinal canal was nearly white. From the absence of any trace of effusion of blood, the sound condition of the exposed adipose tissue, its exemption from the action of the fire, and the irregular character and appearance of the fissures, Mr. Curling concluded that they were not the result of wounds inflicted before the occurrence of the burn; he considered them to have been occasioned by the influence of heat, which had forcibly corrugated the skin and completely destroyed its elasticity, and the superficial layer of adipose tissue being closely adherent to the cutaneous tissue, necessarily gave way at the same time. In several places some small vessels containing blood were observed running across the fissures; these, being more tenacious than the adipose tissue, had not yielded with it. This appearance alone was sufficient to negative the supposition of the infliction of wounds by cutting instruments. The production of the fissures might have been aided by the child's struggles immediately after the occurrence of the burn, but it did not appear that these were at all violent. The conclusion at which Mr. Curling arrived was justified by the facts; and the case is calculated to throw an important light on the accidental origin of fissures or wounds of the skin in cases of death from burns.

Summary.—The conclusions which, it appears to me, we may draw from the foregoing statements, are: 1, that, as a general rule, when we discover marks of vesication, with serous effusion, or a line of redness, or both, about a burnt part of the body, we are justified in saying that the burn has occurred during life; 2, that when these appearances are not met with, it by no means follows that the burn had not been produced in the living body: the affirmative evidence derived from such appearances being much stronger than the negative.

Cause of death.—Whether a burn or a scald was or was not sufficient to account for death, must be determined by the extent, depth, and situation of the injury; but even when the burn has clearly been caused during life, the body should be carefully examined for other marks of violence, such as blows upon the head, wounds, marks of strangulation,—and internally for hæmorrhage, disease, or poisoning. It must be remembered, that in burns which are rapidly fatal, the serous liquid found in the cavities has commonly a red colour, and the mucous membranes are also reddened.

The subject of *scalding* scarcely requires a separate notice. A scald from boiling water would, when recent, be indicated by vesication and the sodden state of the skin. The living structures are not charred or disorganized as by the application of a red-hot solid. At the Liverpool Summer Assizes, 1847, a woman was convicted of throwing boiling water over her husband, with intent to maim him. (*Reg.* v. *King.*) In another case (*Reg.* v. *Blewitt*, Worcester Summer Assizes, 1847), the prisoner was convicted of the manslaughter of his wife by pouring over her the contents of a kettle of boiling water. At the Stafford Winter Assizes, 1859 (*Reg.* v. *Hill*), a man was convicted of feloniously casting boiling water over the prosecutor with intent to do him grievous bodily harm. The medical evidence was to the effect that the scalds were on the head, cheek, neck, and arm, and were of a dangerous character. A woman at Glasgow attempted to kill her husband by pouring boiling water over his genital organs while he was asleep in bed. He died, but his death could not be clearly traced to this cause. These are the only recent instances of criminal scalding which are reported.

HUMAN OR SPONTANEOUS COMBUSTION.

Supposing that a dead body is found burnt, and there is no apparent cause of death about it, it may be said that the burning was neither the result of accident nor of homicide, but that it was the effect of spontaneous or human combustion. There are two opinions concerning this so-called spontaneous destruction of the human body. On the one hand, it is alleged that the combustion may take place from internal causes, *i. e.* that the process is literally *spontaneous*; on the other hand it is contended that the contact of a substance in a state of ignition is necessary for the production of the phenomenon,—so that, according to this view, the human body merely becomes preternaturally combustible. The hypothesis of those who advocate *spontaneous* combustion, is, it appears to me, perfectly untenable. So far as I have been enabled to examine this subject, there is not a single well-authenticated instance of such an event:—in the cases reported which are worthy of any credit, a candle, or some other ignited body, has been at hand, and the accidental ignition of the clothes was highly probable, if not absolutely certain. It is in vain that they who adopt this hypothesis appeal to the electrical state of the atmosphere or of the individual, coupled with the impregnation of the system with the inflammable principles of alcohol, as conditions sufficiently explanatory of their views, — such explanations may be reserved until the occurrence of this spontaneous combustion from internal causes is placed beyond all dispute. For a full description of the phenomena which are said to accompany this condition, I may refer the reader to Casper's Wochenschrift, 1841, Nos. 8, 9, 10; also, Henke's Zeitschrift der S. A. 1842, vol. 2, p. 228; 1843, vol. 2, p. 39; and the Ann. d'Hyg. 1851, vol. 1, p. 99; vol. 2, 383.

We have, then, only to consider, in this place, how far the views of those who allow that the body may acquire preternaturally combustible properties are consistently borne out by facts. It is generally admitted that the unclothed human body is highly difficult of combustion; and therefore, if in any case the degree to which it is consumed by fire is great in proportion to the small quantity of combustible matter destroyed about the person, it appears not unreasonable to refer this to its possessing greater combustible properties. This is precisely the species of evidence which is furnished by the alleged cases of spontaneous combustion: the body has been found almost entirely consumed, and the clothes and other articles of furniture surrounding it but little injured. It must be remembered, however, that a crafty assassin may employ naphtha or some other inflammable spirit, of which no trace will be found, and the secret destruction of the body may therefore be due to this extraneous cause, and not to any increased combustibility of its parts. The contact of a volume of flame will speedily consume the body, owing to its high temperature and the large surface which it would at once envelope. Articles of female dress, from the quantity of air enclosed between the layers, are capable of producing much flame: — and in a body in which fat predominated, this would, after a time, add to and augment the effect of other combustibles with which it might be surrounded. Even allowing that the human body may, in certain cases, acquire increased combustible properties, the medical jurist will perceive that this admission does not involve any difficulty in the judicial determination of a question of murder by burning, since it is contended that the combustion of the body cannot take place except by contact with ignited substances. But whether the ignition of the clothes of a deceased person took place accidentally, or by the criminal act of an accused party, is a totally different question, — it is one in which a medical jurist is no more concerned than a non-professional witness, — this is, in fact, a point which can be cleared up only by general or circumstantial evidence. If it be admitted that the body of one person will burn more rapidly and completely than that of another, this will be no ground of exculpation to a prisoner who is proved to have wilfully set fire to the clothes of that person. It may be urged in defence, that the prisoner might not have intended to destroy the deceased; and that although he ignited the clothes, he did it without any malicious intention; and that death would not have been caused by his act, but for the preternatural combustibility of the body of the deceased! The intention which a person may have had in setting fire to the clothes of another, when he could not possibly know to what degree the burning would extend, is, of course, a question for a jury, to be decided from the circumstances. The relation of this subject of the alleged spontaneous combustion of the body to medical jurisprudence, appears therefore to have been much exaggerated. The only credible part of the doctrine can never present any sort of difficulty to a medical jurist.

Homicidal mistaken for spontaneous combustion.—It is singular that, so recently as the year 1850, some German physicians should have been found to advocate the hypothesis of spontaneous combustion in a case of murder. A trial took place at Darmstadt in March and April 1850, in which a man named *John Stauff* was charged with the murder of his mistress, the *Countess of Goerlitz.* The Countess was found dead in her apartment: the dress on the upper part of the body was almost wholly consumed: the head exhibited the form of a nearly shapeless black mass, in which the mouth was imperfectly distinguishable, with the charred tongue protruding from it. The skin of the neck, as well as the skin and muscles of the face and upper part of the chest, were much blackened and charred. The joints of both arms were charred on their surfaces, and the blackened ends of the bones protruded. There were no marks of fire on the clothes anywhere beyond the margins of the burns on the body. A writing-desk near the body had been partially burnt, and the floor beneath and in front of the desk, over a space of a foot and a half, had been entirely consumed. The feet of a chair placed near the writing-desk were slightly charred. A folding board and the drawers were also much burnt. With this clear evidence of the partial destruction of a human body by fire, the physician who was consulted could suggest no other explanation of the phenomena, than that the body of the Countess must have taken fire *spontaneously*, while she was engaged in writing at her desk! He could not even admit that her cap or dress might have become ignited by a candle, because, had this been the case, she would, in his opinion, have had time to escape or call for assistance! The other reasons assigned for the adoption of this hypothesis were, that deceased went to bed in good health, —that there was a greasy black or sooty substance found about the room, and the body exhaled an empyreumatic odour. It may be observed that when the room was first broken into, and the Countess was found dead, flames burst out simultaneously from the hangings, the writing-desk, and the floor beneath it, which required to be extinguished by the ordinary process,—

namely, by water. The scientific opinion thus given amounted to this — the Countess's body had undergone slow combustion until it reached a full red heat; it then ignited the furniture around! The Countess was thus found dead on the 13th of June, 1847. On the 26th of November of that year, it was intimated to the Count that an inquest would be held, and the valet Stauff, having made an attempt to poison his master, was then first suspected of having murdered the Countess, the death by burning having up to this time been treated as an accidental occurrence. The body, which had been buried, was exhumed on the 11th of August, 1858, *i. e.* fourteen months after death: it was subjected to a special examination, and the Hessian Medical College, to whom the case was referred, came to the conclusion that the Countess had not died from spontaneous combustion. The case was subsequently referred to Prof. Liebig and Bischoff, of Giessen, and their report was issued in March 1850, at which date the man Stauff was put on his trial. They found no difficulty in coming to the conclusion that a murder had been perpetrated, and the body wilfully burnt after death for the purpose of concealing the crime. There was some doubt whether the deceased had died from strangulation or from violence to the head. Stauff was convicted upon circumstantial evidence. He subsequently confessed that the Countess had entered her room as he was in the act of committing a robbery. A struggle took place, he seized her by the throat, strangled her, and afterwards placed the body in a chair, piling around it combustible articles of furniture. He set fire to these with the view of destroying the proofs of his crime. It will be observed that the tongue was found protruded, as it is in violent strangulation, and in its charred state it retained the position given to it by the act of murder.

One of the difficulties in the case (as it was considered before the facts were known) was, that the body appeared to have been so much consumed compared with the amount of combustibles near it: another point which excited notice was, that the clothes were not consumed beyond the margins of the burns on the body, — a circumstance which has been hitherto regarded as a special character of spontaneous combustion. The dark greasy matter on the furniture and the empyreumatic smell are also conditions which by this case are proved to be the results of homicidal attempts to conceal a foul murder, and they are not indications of spontaneous combustion. (See, for a further report of this case by Dr. Ogston, Medical Gazette, vol. 46, pp. 889 and 948.)

Time required for the burning of a dead body. — It may be a medico-legal question, whether, on discovering a body thus burnt, it could be determined from its appearance how long a period it would require to produce the amount of destruction observed. An answer to such a question may appear necessary, in order to connect a person with the perpetration of a crime; but the question does not admit of a precise answer: a conjecture may be formed from the facts proved in each particular case. The human body contains a large proportion of water: this gives to the soft structures a power of resisting combustion. At the same time there is a quantity of fat in the body, varying in different parts, but amounting to an average of about five per cent. This tends to increase its combustibility; and this is still further increased if it be placed on any combustible articles,—such as a rug or a deal floor. The nature of the dress will also make a difference. Under a strong and active flame, which might subsequently burn out before the discovery of the body, there would be a degree of destruction in half an hour which a more slow and smothered combustion would not effect in several hours. In the case of the Countess of Goerlitz, it was proved that she retired to her room between three and four o'clock in the afternoon;—the Count returned at seven o'clock, and knocked at the door of her anteroom, but, receiving no answer, he again went out. Had the burning of the body then commenced he would have perceived it by the smell, or by the appearance of smoke. He returned again at nine o'clock, and during this second absence, covering an interval of *two hours*, a bright light had been seen at one of the windows, and a thick smoke issued from one of the chimneys. There is a little discrepancy as to the time, but, taking the maximum, the amount of destruction described in this case (p. 405) must have occupied less than two hours, and probably not more than one hour.

This question actually arose in *Reg.* v. *Hatto* (Aylesbury Lent Assizes, 1854). The deceased, a female, was found dead in her room, and her body much burnt. She was last known to be living at about a quarter past eight o'clock in the evening, and her body was found with fire still smouldering on the floor of the room at about a quarter past eleven o'clock. The only persons known to have been in the house were the prisoner and deceased. The prisoner pretended that he knew nothing of the circumstances attending her death, and endeavoured to make it appear that robbers might have broken into the house, and committed the murder, at some period of the three hours during which he alleged that he was asleep in bed. For the prosecution, it was suggested, in order to exclude this hypothesis, which, however, was sufficiently excluded by other facts, that the act of murder, with the attendant burning, must have occupied the whole of the time intervening between the period at which deceased was last seen living, and the period at which her body was found. The medical gentleman who examined the deceased found that "both knees were consumed by fire, and the thighs also burnt to a cinder; the private parts also,—leaving the shafts of the thigh-bones exposed and charred for several inches. Between the thighs and feet, the floor underneath was burnt away, and the leg-bones had fallen through the floor, leaving the feet unburnt on the floor." He expressed an opinion that it would take from two and a half to three hours in order to consume the body to this degree; thus covering the whole interval during which deceased and prisoner were in the house together. It should be stated, that the clothes of the deceased were much burnt, and that beneath the body there was a hempen mat, so combustible owing to the melted human fat with which it was impregnated, that when ignited it burnt like a link. The guilt of the prisoner did not depend on an answer to this question; that was made sufficiently clear from other circumstances proved in the case, which were quite inconsistent with his innocence. It is obvious that an opinion on such a subject must be in all cases conjectural, since the effects, *cæteris paribus*, depend as much on the intensity as on the duration of the heat. It was indeed just as probable, medically speaking, that, with a large body of flame, the amount of injury met with might have been produced in an hour as in three hours; and if the question were proposed to any number of medical men in entire ignorance of the bearing which their answers would have on the case, there would be probably no two answers alike. The confession of the prisoner, subsequently made, shows that the burning observed must have taken place in less than two hours, and probably within an hour and a half. The Goerlitz case and some others prove that a short period may suffice for a large amount of destruction, and that, judging by what remains, the combustible materials consumed appear to bear only a small proportion to the parts of the body burnt.

BURNS BY CORROSIVE LIQUIDS.

Among the cases in which medical evidence is sometimes required, are those of throwing sulphuric acid or other corrosive liquids on the person. This crime was at one time prevalent, and there was no adequate punishment for it. On one occasion, the prisoner escaped the charge of felony, because it could not be considered in law, that sulphuric acid was capable of producing a *wound*—the man having been indicted for wounding! This case clearly showed a strong necessity for some legal definition of a wound, as well as the uncertainty of medical opinions: for while one surgeon considered that the injury produced was a wound, another thought that it was not. The judges decided that it was not a wound within the meaning of the statute. (*The King* v. *Murrow*, Liverpool Aut. Assizes, 1835.) The Act 1 Vict. c. 85, s. 5., while it punishes the offence, omits all reference to a definition of the word wound. The nature of the liquid thrown is merely defined in general terms to be "any corrosive fluid or other destructive matter"—

a point which will require medical evidence for its elucidation. In common language, and according to the statute, the injury thus produced is called a burn; but it is wholly different in its origin, as well as in its progress. I do not know that there has been a single instance in which such an injury has directly destroyed life; but great deformity and actual blindness have resulted. A medical man is sometimes required to distinguish these injuries from burns and scalds:—this may be easily done in the first instance, by the appearance of the part injured, as well as by the description of the first symptoms. The stain is brown when sulphuric acid has been used, and yellow when nitric or muriatic acid has been employed. The eschar is soft, and not dry as in a burn from a heated solid. The skin touched by a concentrated acid is destroyed and sloughs away, exactly to the extent of the part to which the corrosive liquid was applied, leaving a suppurating and granulating surface. There is no capillary congestion or redness of the cutis around the injury as in a burn. The period of recovery will depend on the extent of the injury. Although a person may not die from the direct effects of the acid, yet in certain irritable constitutions the inflammation which follows in deep-seated parts may prove fatal. In infants, or delicate nervous females, an extensive injury thus produced may readily destroy life. In the case of *Miss Cashin*, for whom an escharotic liniment was prescribed by a quack, there was no doubt that death was caused by the great local mischief produced by the application. The nature of the acid may be determined by applying wetted linen to the part when the injury is recent, and examining the liquid thus absorbed. In general, however, evidence is readily obtained by examining the spots or stains left on articles of clothing or furniture. Sulphuric acid is most commonly used: but in a case which occurred at Guy's Hospital, nitric acid had been thrown at the person, and had led to the destruction of the sight of one eye. The caustic alkalies might also be used under these circumstances, as well as numerous other liquids, on which the only medical opinion required would be, whether the liquid employed should or should not be considered as corrosive or destructive matter. To constitute a felony, it is necessary that the *person* should have sustained, from the act of throwing, some grievous bodily harm. A damage to clothes only does not fall within the provisions of the statute. Unless vital reaction has taken place, there are no means of distinguishing the effects of a corrosive liquid on the living, from those produced on the dead body. (Ann. d'Hyg. 1859, vol. 1, p. 396.)

The mineral acids are sometimes used in other ways for the destruction of life. In June 1833, a man poured a quantity of strong nitric acid into the ear of his wife while she was lying asleep. She awoke suddenly with a violent pain in the ear, which continued for three days, whereby she became weak and exhausted. Soon afterwards there was copious bleeding, and a portion of membrane escaped. She lost the use of her right arm, and became completely deaf. Suppuration took place from the ear, and blood escaped daily. She gradually sank, and died six weeks after the injury, the right half of the body being convulsed before death. On inspection, a portion of the external ear was wanting, and the ear-passage was much wider than natural. The brain, near the petrous portion of the temporal bone, was softened, and the bone itself carious. The injury had led to death indirectly by producing disease of the brain. (Medical Gazette, vol. 17, p. 89.)

In a case tried at Aberdeen, a woman poured oil of vitriol down the throat of her husband while he was lying asleep with his mouth open. She was tried and convicted of the murder. In another case at Aberdeen, a woman killed her husband by pouring a solution of corrosive sublimate down his throat while asleep. These, however, were treated as cases of poisoning, as death did not depend on the local or *external* mischief produced by the corrosive agent employed.

INFANTICIDE.

CHAPTER 39.

NATURE OF THE CRIME—THE SAME EVIDENCE REQUIRED AS IN OTHER CASES OF MURDER—PROOF OF LIFE DEMANDED—BODY OF THE CHILD NOT DISCOVERED—MEDICAL EVIDENCE AT INQUESTS—AGE OR MATURITY OF THE CHILD—VIABILITY NOT REQUIRED TO BE PROVED—CHARACTERS FROM THE SIXTH TO THE NINTH MONTH—SIGNS OF MATURITY—ABNORMAL DEVIATIONS—POSITION OF THE UMBILICAL OPENING—GENERAL CONCLUSIONS—RULES FOR INSPECTING THE BODY.

Nature of the crime.—By infanticide we are to understand, in medical jurisprudence, the murder of a *new-born* child. The English law, however, does not regard child-murder as a specific crime; it is treated like any other case of murder, and is tried by those rules of evidence which are admitted in cases of felonious homicide. In stating that infanticide is the term applied to the murder of a *new-born* child, it is not thereby implied that the wilful killing should take place within any particular period after birth. Provided the child be actually born and its body entirely in the world, it matters not whether it has been destroyed within a few minutes, or not until several days after its birth. In the greater number of cases of infanticide, however, we find that the murder is commonly perpetrated within a few hours after the birth of the child. Although the law of England treats a case of infanticide as one of ordinary murder, yet there is a particular difference in the medical evidence required to establish the murder of a new-born child. It is well known that in the course of nature, many children come into the world dead, and that others die from various causes soon after birth. In the latter, the signs of their having lived are frequently indistinct. Hence, to provide against the danger of erroneous accusations, the law humanely presumes that every new-born child has been born dead, until the contrary appears from medical or other evidence. The onus of proof is thereby thrown on the prosecution; and no evidence imputing murder can be received, unless it be made certain, by medical or other facts, that the child survived its birth, and was actually living when the violence was offered to it. Hence there is a most difficult duty cast upon a medical witness on these occasions.

Body of the child not discovered.—In cases of child-murder, medical evidence is commonly founded upon an examination of the body of the child; but it must be borne in mind, that a woman may be found guilty of the crime, although the body of the child be not discovered:—it may have been destroyed by burning, or by being otherwise disposed of, and a medical witness may have only a few calcined bones to examine. (Ann. d'Hyg. 1845, vol. 2, p. 129.) In these cases of the non-production of the body, good legal evidence of the murder would, however, be demanded; and this evidence should be such as would satisfactorily establish a matter of fact before a jury. The production of the body of a child is therefore no more necessary to conviction than in any other case of murder. A woman has been tried for the murder of her child, the body of which was not discovered. It must not be supposed from this statement that the fact of the murder is to depend upon the fact of disappearance. There may be clear evidence of a child having been murdered, and its body so disposed of, at or immediately after the act of murder, as to render the production of the body impossible, as where a woman kills her child, and is seen to consume its body by fire, or to throw it at once into the sea, or into a deep lake or pond. In the case of the *Lemoines*, mother and daughter, tried before the French Courts in December, 1859, the evidence went to show that the elder prisoner (the mother) burnt the body of a child of which her daughter had been secretly delivered. Some bones of a child were recovered, and among others the frontal bone. The medical evidence was to the effect, that the bones were those of a child which had reached about the seventh or eighth month. Upon this corroboration the jury convicted the elder prisoner, and the Court sentenced her to twenty years' imprisonment. In a case tried in Edinburgh in 1841, there were strong grounds for believing that the woman had disposed of the body of her child by throwing it to some half-starved pigs which had eaten it.

Medical evidence at inquests.—In most instances, however, the body of the child is found,—an inquest is held, and medical evidence is demanded. In giving evidence at a coroner's inquest on a case of infanticide, as much care should be taken by a practitioner as if he were delivering it before a judge at the assizes. Some witnesses are disposed to treat an inquest with indifference, and to be careless in their evidence, thinking probably that, should the case come to trial, they could prepare themselves and amend any statements which from subsequent reflection might appear to have been hastily made before a coroner. But it ought to be known that the depositions taken by this officer are at the trial placed in the hands of the judge as well as of the prisoner's counsel; and should a witness deviate in his evidence at the assizes from that which he gave at the inquest, or should he attempt to amend or explain any of the statements then made, so that they might, by the ingenuity of a barrister, be represented as having a new bearing on the prisoner's case, he would expose himself not merely to a severe cross-examination, but probably to the censure of the Court. If medical men were to reflect that in delivering their opinions before a coroner and jury, they are, in many instances, virtually delivering them before a superior Court, it is certain that many unfortunate exposures would be easily avoided.

UTERINE AGE OR MATURITY OF THE CHILD.

One of the first questions which a witness has to consider in a case of alleged child murder, is that which relates to the age or probable degree of maturity which the deceased child may have attained in utero. The reason for making this inquiry is, that the chances of natural death, in all new-born children, are great in proportion to their immaturity: and that supposing them to have survived birth, the signs of their having respired are commonly obscure. It is found that the greater number of children who are the subjects of these investigations have reached the eighth or ninth month of gestation: yet charges of murder might be extended to the wilful destruction of children at the seventh month or under, provided the evidence of life after birth was clear and satisfactory.

Proof of viability not required.—The English law does not act on the principle that a child, in order to become the subject of a charge of murder, should be born *viable*, *i. e.* with a capacity to live. It is observed by Mr. Chitty, although no authority is quoted for the statement, that "the object of the law is to prevent injuries to infants having capacity to maintain a separate existence;" and he further suggests that such a capacity should be proved, in order to complete the offence of infanticide. (Med. Jur. vol. 1, p. 411.) This argument, carried to its full extent, would render it no offence to put to death all persons afflicted with any mortal disease. I have been unable to find, in the numerous reported trials for infanticide, any ground for this statement. The capacity of a child continuing to live has never been put as a medical question in a case of alleged child-murder; and it is pretty certain, that if a want of capacity to live were actually proved, this would not render the party destroying it irresponsible for the offence. Children may be born alive at the sixth or seventh month; but because they are much less likely to survive than those born at the eighth or ninth month, this is not a ground of exculpation for any person who may wilfully destroy them. The real question, as we shall presently see, does not refer to the period of gestation at which a child may be born, but to the fact of its being *living* and *entirely born* when the murderous violence is offered to it. The French law, although it requires in some cases proof of viability in relation to the rights of inheritance, demands only proof of life after birth in reference to a charge of infanticide. (Briand, Man. Complet de Méd. Lég. 201.)

Although the doctrine of viability is not recognized in English jurisprudence, yet in a case which occurred in October 1836, a coroner refused to hold an inquest on the body of a child, because it had not reached an age (seven months) at which children are commonly born alive! In this case there was probably no harm done; but when we consider — 1st, the great difficulty of determining the exact age of a child from the characters found on its body; and 2nd, that many children born under the seventh month have not only been born alive, but have lived to adult age, the acting on a principle of this kind would be likely to give rise to dangerous abuses. It is impossible to admit that children are to be destroyed with impunity because they happen to be born under the seventh month, or that a child should be assumed to have been born dead and any inquiry into the cause of death dispensed with, unless it can be medically established that it has passed the seventh month of gestation.

According to one medico-legal authority, if it can be proved that the child which is the subject of investigation has not attained this age (the seventh month), no charge of infanticide *can* or *ought* to be entertained. Are we to understand by this, that children proved to have been born living before the seventh month, may be wilfully destroyed, and the law take no cognisance of the matter? If this be not the meaning, the statement amounts to nothing, because whether the child has reached the seventh, eighth, or ninth month, life and live birth must still be proved, before the question of murder can be entertained. I have known an instance of a child born between the sixth and seventh months living a fortnight; and many similar cases are recorded. On the doctrine above laid down, the deliberate destruction of such children, although actually living, ought not to be considered or treated as murder! It is satisfactory to know that such a principle as this is not recognized by the law of England. In the case of *Reg.* v. *West* (Nottingham Lent Assizes, 1848), a midwife was tried on a charge of causing the death of a child under the seventh month of uterine life (in the perpetration of abortion), not by direct violence applied to its body, but merely by leading to its premature birth. This case proves, therefore, that a case of infanticide may be fairly entertained with respect to children *under* the seventh month. The female in this instance was alleged to have been between the fifth and sixth month of pregnancy. The proof of this fact did not, however, prevent an indictment for murder, or a full investigation of the facts of the case. We also learn from it, contrary to the suggestion of Mr. Chitty (*supra*), that the *viability* of a child is not by the English law required to be proved on an indictment for child-murder. This child was certainly from mere immaturity incapable of maintaining a separate existence, and it was therefore *not viable*; but the judge who tried the case, in answer to an objection taken by prisoner's counsel, said that if the child was proved to have died under the circumstances alleged for the prosecution, it would be murder.

Characters from the sixth to the ninth month.— The following are the characters whereby we may judge of the uterine age of a child from the *sixth* to the *ninth* month of gestation, a period which may be considered to comprise all cases of child-murder. Between the *sixth* and *seventh* :— The child measures, from the vertex to the sole of the foot, from ten to twelve inches, and weighs from one to three pounds. The head is large in proportion to the trunk, — the eyelids are adherent, and the pupils are closed by membranes (membranæ pupillares). The skin is of a reddish colour, and the nails are slightly formed; — the hair loses the silvery lustre which it previously possessed, and becomes darker. Ossification proceeds rapidly in the chest-bone, and in the bones of the foot. The brain continues smooth on its surface; — there is no appearance of convolutions. In the male the testicles will be found in the abdominal cavity, lying upon the psoæ muscles immediately below the kidneys. Between the *seventh* and the *eighth* months:—The child now measures between thirteen and fourteen inches in length, and weighs from three to four pounds. The skin is thick, of a more decidedly fibrous structure, and covered with a white unctuous matter, which now for the first time appears. Fat is deposited in the cellular tissue, whereby the body becomes round and plump: — the skin, previously to this, is of a reddish colour, and commonly more or less shrivelled. The nails, which are somewhat firm, do not quite reach to the extremities of the fingers. The hair becomes long, thick, and coloured. Ossification advances throughout the skeleton. Valvulæ conniventes appear in the small intestines, and meconium is found occupying the cæcum and colon. The testicles in the male are considered about this period to commence their descent, — or rather, the child's head being downwards, their ascent towards the scrotum. The time at which these organs change their situation is probably subject to variation. According to J. Hunter, the testicles are situated in the abdomen at the seventh, and in the scrotum at the ninth month. Burns believes that at the eighth month they will commonly be found in the inguinal canals. The observation of the position of these organs in a new-born male child is of considerable importance in relation to maturity, and it may have an influence on questions of legitimacy as well as of child-murder. Mr. Curling thus describes their change of position : — At different periods between the fifth and sixth months of fœtal existence, or sometimes later, the testicle begins to move from its situation near the kidney towards the abdominal ring, which it usually reaches about the *seventh* month. During the eighth month it generally traverses the inguinal canal, and by the end of the ninth, arrives at the bottom of the scrotum, in which situation it is commonly found at birth. (Diseases of the Testis, 2nd ed. p. 17.) Its absence from the scrotum does not necessarily indicate that the child is immature, because the organ sometimes does not reach the scrotum until after birth.

Between the *eighth* and *ninth* months the child is from fifteen to sixteen inches in length, and weighs from four to five pounds. The eyelids are no longer adherent, and the membranæ pupillares will have disappeared. The quantity of fat deposited beneath the skin is increased, and the hair and nails are well developed. The surface of the brain is grooved or fissured, but presents no regular convolutions: and the cineritious matter is not yet apparent. The meconium occupies almost entirely the large intestines; and the gall-bladder contains some traces of a liquid resembling bile. The testicles in the male may be found occupying some part of the inguinal canal, or they may be in the scrotum. The left testicle is sometimes in the scrotum, while the right is situated about the external ring.

Signs of maturity.—At the ninth month the average length of the body is about eighteen inches, and its weight about six pounds, or between that and seven pounds: the male child is generally rather longer, and weighs rather more than the female. Extraordinary deviations in length and weight are occasionally met with. Mr. Owens has recorded a case in which the child at delivery measured twenty-four inches, and weighed seventeen pounds twelve ounces, (Lancet, December 1838), and Dr. Meadows has reported another in which the child measured after death thirty-two inches, and weighed eighteen pounds two ounces. The child survived four hours. (Med. Times and Gaz. Aug. 4, 1860.) In a case which I was required to examine in June 1842, the child, a male, measured twenty-two inches, and weighed twelve pounds and a half. (For some practical remarks on the subject, by Dr. Ellsässer, see Henke's Zeitschrift, 1841, vol. ii. p. 235.) At the full period, the head of a child is large, and forms nearly one fourth of the whole length of the body. The cellular tissue is filled with fat, so as to give considerable plumpness to the whole form, while the limbs are firm, hard, and rounded. The skin is pale. The hair is thick, long, and somewhat abundant. The nails are fully developed, and reach to the ends of the fingers;—an appearance, however, which may be sometimes simulated in a premature child, by the shrinking of the skin after death. The testicles in the male are generally within the scrotum. Ossification will be found to have advanced considerably throughout the skeleton. (See, in relation to the progress of ossification, a paper by M. Ollivier, Ann. d'Hyg. 1842, 243.) The surface of the brain presents convolutions, and the cineritious matter begins to show itself. The internal organs, principally those of the chest, undergo marked changes, if the act of respiration has been performed by the child before, during, or after its birth.

The relative position of the point at which the *umbilical cord* is attached to the abdomen, has been considered by some medical jurists to furnish evidence of the degree of maturity. Chaussier thought that in a mature child, at the ninth month, the point of attachment of the cord exactly corresponded to the centre of the length of its body. Later observations, however, have shown that this is not quite correct. Out of five hundred children examined by M. Moreau, at the Maternité, in Paris, the umbilical aperture corresponded to the centre of the body in *four* cases only. In the majority of these cases, the point of insertion was eight or nine lines below the centre. Among many cases of mature children which I have had an opportunity of examining, the umbilical aperture has generally been situated from a quarter to half an inch below the centre of the body. (Guy's Hosp. Rep. April 1842.) M. Moreau found, on the other hand, that in some children, born about the sixth or eighth month, the cord was attached at the middle point of the length. (Lanc. Franç. 1837.) On the whole, it will be perceived that no value can be attached to the situation of the umbilical opening, as a sign of maturity or immaturity.

The characters which have been here described as belonging to a child at the different stages of gestation, must be regarded as representing an average statement. They are, it is well known, open to numerous exceptions; for some children at the ninth month are but little more developed than others at the seventh; although the converse of this proposition is not true—*i. e.* we do not find that children of the seventh month have undergone such premature development as to be mistaken for children at the ninth month. Twins are generally less developed than single children; — the average weight of a twin child is not more than five pounds, and very often below this. The safest rule to follow in endeavouring to determine the uterine age of a child is to rely upon a majority of the characters which it presents. That child only can be regarded as *mature*, which presents the greater number of the characters above described, and which are met with in children at or about the ninth month of gestation.

If the age of the child has been determined : — whether it be under or over the seventh month, the rules for a further investigation will be the same. Should the child be under the seventh month, the medical presumption will be, that it was born dead ; but if it has arrived at its full period, then the presumption is that it was born alive.

Conclusions.—The following may be taken as a summary of the principal facts upon which our opinion respecting the uterine age of a child may be based : —

1. At *six months.*—Length, from nine to ten inches ; weight, one to two pounds ; eyelids agglutinated ; pupils closed by membranæ pupillares ; testicles not apparent in the male.

2. At *seven months.*—Length, from thirteen to fourteen inches ; weight, three to four pounds ; eyelids not adherent ; membranæ pupillares disappearing ; nails imperfectly developed ; testicles not apparent in the male.

3. At *eight months.*—Length, from fourteen to sixteen inches ; weight, from four to five pounds ; membranæ pupillares absent ; nails perfectly developed, and reaching to the ends of the fingers ; testicles in the inguinal canal.

4. At *nine months.* — Length, from sixteen to twenty-one inches ; weight, from five to nine pounds : membranæ pupillares absent; head well covered with fine hair; testicles in the scrotum ; skin pale ; features perfect—these and the body are *well developed* even when the length and weight of the child are less than those above assigned.

5. The point of attachment of the umbilical cord, with respect to the length of the body, affords no certain evidence of the degree of maturity.

Inspection of the body.—The questions which a medical jurist has to solve, in examining the body of a new-born child, are— 1. To determine its age, or the stage of uterine life which it has reached ;—2. Whether it has lived to breathe :—3. Whether it has been born alive ;—4. The period of time which has elapsed since its death ;—5. The cause of death, whether violent or natural.

Hence, before commencing the inspection —

1. The length (measured from the vertex to the sole of the foot) and weight of the body should be taken :—2. The presence or absence of external fœtal peculiarities noticed :—3. Any peculiar marks or indications of deformity whereby identity may be sometimes established :—4. All marks of violence, in the shape of wounds, bruises, or lacerations, and the kind of instrument or weapon by which they were probably produced :—5. Whether the umbilical cord has been cut and tied, or lacerated : the appearance of the divided vessels, and the length of that por-

tion which is still attached to the body of the child; — 6. The presence or absence of vernix caseosa about the groins, arm-pits, or neck—the presence of this substance proves that the child has not been washed or attended to; — 7. It will be necessary to state whether there are about the body any marks of putrefaction, indicated by a separation of the cuticle, change of colour in the skin, or offensive odour. It is obvious, that unless these circumstances be noticed before the inspection is commenced they may be entirely lost as evidence. Notes should be made on the spot, and the original retained, even if copies be subsequently made.

CHAPTER 40.

ON THE PROOFS OF A CHILD HAVING LIVED AT ITS BIRTH — EVIDENCE OF LIFE BEFORE RESPIRATION — SIGNS OF PUTREFACTION IN UTERO — EVIDENCE FROM MARKS OF VIOLENCE — SUMMARY — EVIDENCE OF LIFE AFTER RESPIRATION — INSPECTION OF THE BODY — COLOUR, VOLUME, CONSISTENCY, AND ABSOLUTE WEIGHT OF THE LUNGS — STATIC TEST — WEIGHT INCREASED BY RESPIRATION — TEST OF PLOUCQUET — BLOOD IN THE PULMONARY VESSELS — RELATIVE PROPORTION OF FAT IN THE LUNGS — SPECIFIC GRAVITY OF THE LUNGS — GENERAL CONCLUSIONS.

On the proofs of a child having lived at its birth.—The question whether a child was or was not *born alive*, is of the greatest importance in a case of alleged child-murder; and it is unfortunately one which, in respect to the proofs upon which medical evidence is commonly founded, has given rise to considerable controversy. When it is stated that in most cases of alleged infanticide which end in acquittals in spite of the strongest moral presumptions of guilt, the proof fails on this point only, it must be obvious that this question specially claims the attention of a medical jurist. The medical evidence of a child having been alive, when violence was offered to it at its birth or afterwards, may be divided into two parts: 1, that which is obtainable before the act of respiration is performed; and 2, that which is obtainable afterwards. At present it will be proper to confine our attention to the question, whether the child was *alive* when it was maltreated,—the fact of its having been *born* alive will be a matter for future consideration. These two questions have been frequently but improperly associated, thus rendering the subject confused; but it must be so obvious as scarcely to require stating, that violence of a murderous kind may be offered to a living child *before* it is entirely born; and that owing to this violence it may come into the world dead.

EVIDENCE OF LIFE BEFORE RESPIRATION.

It was formerly supposed, that if the lungs contained no air, the child could not have respired, and that it must have been born dead. But neither of these views is correct:—children have been known to respire faintly, and continue in existence many hours without visibly distending the cells of the lungs with air,—the absence of air from the lungs, therefore, furnishes no proof either that respiration has not been performed, or that the child has not lived. (G. H. Rep. April 1842.) The restoration of many children apparently born dead is a clear proof that many are born living who might be pronounced dead, simply because breathing and life have been considered synonymous terms. (See on this subject a paper by Dr. Märklin Casper's Vierteljabrschr, 1859, vol. 2, p. 26; also an article in the same volume "Leben ohne athmen." p. 297.) That our law-authorities will admit evidence of life in a child before the establishment of respiration, is clear from the decision in *Rex* v. *Brain*, in which the judge said, that a child might be born alive, and not breathe for some time after its birth (Archbold, Crim. Plead. 367), as also from the charge of Coltman J. in the case of *Rex* v. *Sellis* (Norf. Spr. Circ. 1837). In this instance it was alleged that the prisoner had murdered her child by cutting off its head. The judge directed the jury, that if the child were alive at the time of the act, it was not necessary, in order to constitute murder, that it should have breathed. In fact, it would appear that respiration is regarded as only *one* proof of life; and the law will, therefore, receive any other kind of evidence which may satisfactorily show that the child has lived, and make up for the proof commonly derived from the state of the lungs. It will be first incumbent on a medical practitioner to prove that the child under examination has recently died, or in other words, that there are good grounds for believing it to have been *recently living*. Hence, if the body be highly putrefied, either from the child having died in the uterus some time before birth, or from its having been born and its body not discovered until putrefaction had far advanced both internally and externally, the case is utterly hopeless. The medical witness will in general be compelled to abandon the investigation, because the body can furnish no evidence whatever of life after birth. The examination of the thoracic organs would throw no light on the case, for here we are assuming that the lungs are in their fœtal condition.

Signs of Putrefaction in utero.—The phenomena of putrefaction in air require no notice in this place: but the changes which ensue when a child dies and is retained within the uterus, may be briefly adverted to, because they may sometimes form a subject for judicial inquiry. According to Devergie, when a child dies in utero, putrefaction takes place as rapidly as in the open air (Méd. Lég. i. 526); but this is doubtful. In an advanced state of *uterine putrefaction*, the body of the child is so flaccid, that when placed on a table it becomes almost flattened by the mere gravitation of its parts. The skin is of a reddish-brown colour, not green as in a putrefied body exposed to air. The cuticle covering the feet and hands is white, and sometimes raised in blisters,—the cellular membrane is filled with a reddish-coloured serum, the bones are movable, and readily detached from the soft parts. In the opinion of Devergie, the principal difference between uterine and atmospheric putrefaction in the body of a new-born child, is seen in the colour assumed by the skin:—but it must be remembered, that should the child remain exposed to the air after its expulsion, the skin may acquire the colour observed in cases of atmospheric putrefaction. The changes which have just been described are such as we may expect to find when the child has been retained in utero eight or ten days after its death. When it has remained for some weeks in the uterine cavity, the body has occasionally been found saponified, or even encrusted with phosphate of lime. If in any case we are able to state distinctly that the body of a child has undergone uterine, and not atmospheric, putrefaction, it is clear that it could not have come into the world alive. Under ordinary putrefaction in air, the child may have been really brought into the world living, and the process may have destroyed every proof of that fact.

Let us suppose that the child died in utero from forty-eight to twenty-four hours before it was born: if it be soon afterwards examined, there will be no marks of putrefaction about it, and the appearances will closely resemble those met with in the body of a child that has been born alive, and died without respiring: or of one that may not have been born alive, but have died in the act of birth. It will be impossible to say, in such a case, whether the child came into the world living or dead.

Evidence from marks of violence.—It has been proposed to seek for evidence of life, under these circumstances, by observing the characters presented by marks of violence on the body. In general, when children are murdered, the amount of violence inflicted is considerably greater than that which is required to destroy them, whereby satisfactory proofs of the crime are occasionally obtained. On the other hand, the body of a still-born child, dead from natural causes, is often covered with lividities and ecchymoses;—the fœtal blood does not coagulate with the same firmness as in the adult: hence the evidence derivable from the extent, situation, and characters of marks of violence, is generally of too vague and uncertain a kind to allow of the expression of a medical opinion that the child was living when the violence was offered to it. The characters which have been already described as peculiar to wounds and contusions inflicted during life, may be met with in a child, whether it has breathed, or died without respiring. So, again, these characters are open to the exceptions there pointed out; for they will be equally present, supposing the wounds to have been inflicted immediately after the cessation of respiration or circulation in the child, or after the cessation of circulation only,— if the act of respiration has not been performed. Marks of violence on the body of a child that had died in utero twenty-four or forty-eight hours before it was born, would not present the characters of injuries inflicted on the living. There would be no ecchymosis and no effused coagula of blood. These marks, when they exist, although they may establish that a child was either living or but recently dead at the time they were inflicted, can never show that it was born alive. Injuries met with on the bodies of children alleged to have been born dead ought, however, to be of such a nature as to be readily explicable on the supposition of their having arisen from accident. If, from their nature, extent, or situation, they are such as to evince a wilful design to injure, it is a fair ground for a jury,— not for a medical witness, to inquire why these extensive wounds, or other marks of violence, were inflicted on a child, if, as it is alleged, it was really born dead. It must be confessed that in such a case there would be a strong moral presumption of murder, although medical proof of life, or actually live birth, might totally fail.

Summary.—As a summary of these remarks, it may be observed, that although physiologically a child may live for a certain period after its birth without respiring,— and legally its destruction during this period would amount to murder, yet there are at present no satisfactory medical data to enable a witness to express a positive opinion on this point. If other evidence were adduced of a child having lived and been destroyed under these circumstances,— as where, for example, a woman causes herself to be delivered in a water-bath, or an accomplice covers the mouth of an infant in the act of birth, or immediately after it is born,— a medical witness would be justified in asserting that the absence of the signs of respiration in the lungs was no proof that the child had been born dead. Indeed, it is apparent that the process could not be established, owing to the criminal means actually employed to prevent it. Whether a jury would convict upon such evidence is doubtful: but this is of no importance to the witness:— his statements ought always to be made according to correct and well-ascertained principles, and not for the purpose of procuring either the conviction or acquittal of parties accused of offences against the law. In general, those cases' in which questions relative to life before respiration might arise are stopped in the Coroner's Court,— the usual practice being, when the signs of respiration are absent or imperfect, to pronounce that the child was born *dead*. If the lungs sank in water, the presence of marks of violence on the body would be considered as furnishing no evidence:— for the sinking of the lungs would be taken as positive evidence of still-birth, an inference upon which some remarks will be made in speaking of the hydrostatic test. The following case was the subject of a criminal charge at Havre, in 1828:—A woman was delivered of twins. So soon as the first child was born, but not before it had breathed, she killed it by fracturing its skull with a wooden shoe. In a few minutes afterwards the second child was born, but scarcely had its head presented, when she seized it and fractured its skull in the same manner. This double crime was soon discovered. On an examination of the bodies of both children, the same degree of violence was found, presenting in each case precisely similar characters. There could be no doubt, from the appearance of the injuries, that they must have been inflicted on both children at a time when the circulation was going on. In one child, however, it was proved that respiration had taken place; in the other that it had not. In the latter case many practitioners would at once have affirmed that the child had not lived, because there was no proof that it had respired; and they would have proceeded to draw the inference that this could not have been a case of infanticide. Dr. Bellot, however, stated that, although the child had not breathed, he had no doubt, it had been *born alive*, and that it would have lived to respire, but for the violence inflicted. This opinion was chiefly founded upon the similarity in the characters presented by the marks of violence in the two cases. (Annales d'Hygiène, 1832, vol. 2, p. 199.) See further remarks upon this subject, by M. Ollivier, Ann. d'Hyg. 1843, vol. 1, p. 149; also by M. Devergie, Méd. Lég. 1837, vol. 1, p. 400.

The great question involved in this, and in all similar cases, is the following: — Does the law regard the wilful *prevention of respiration* as murder? There cannot be the slightest medical doubt that living children are occasionally thus destroyed in the act of birth: they die, not from the actual infliction of violence, but because, either through accident or design, the performance of that act which is necessary to maintain existence when the child is born, is prevented. Such a case has not yet been decided, although from the dicta of our judges, it would probably involve a charge of murder. In a case published by Dr. Wharrie, a pregnant woman, thinking she was about to have a motion, sat on an earthen pitcher, two feet in depth, which happened to be full of water. She was there delivered of a child, which fell into the water, and was thus prevented from breathing. The child was full-grown, and its body was free from putrescency. It weighed six pounds, and measured twenty inches. There were no external marks of violence, and the cord had been *tied.* The lungs weighed two and a half ounces; they were of a liver colour, contained no air, and sank in water. The medical opinion was, that from the size and general appearance of the child, and the state of the parts discovered on dissection, it was mature,—that it had never breathed, and life might have been either wilfully or accidentally destroyed. The examiners wisely declined giving the usual opinion from the sinking of the lungs; *i. e.* that the child had been born dead. The woman was not prosecuted, probably on the assumption that the death of the child might have been accidental. As Dr. Wharrie truly observes, there was no medical proof that the child was born alive; although there was a strong moral presumption that life was extinguished after birth. (Ed. Monthly Jour. Oct. 1845, p. 796.)

Dr. Bayard mentions a case, in which a female, under somewhat similar circumstances, was convicted of the murder of her infant, and sentenced to the galleys for five years. In this case there was no evidence of respiration, but the woman admitted that she fractured the skull of the child, with the intention of destroying it, thinking that she perceived a motion in its legs after it was born. (Ann. d'Hyg. 1847, vol. 1, p. 455.) One physician thought that the child was living when the blows were inflicted; two others that it was dead. In Dr. Bayard's opinion the absence of the signs of respiration must be taken as a negative circumstance in favour of the accused.

EVIDENCE OF LIFE AFTER RESPIRATION.

There is no doubt that the proof of the act of respiration furnishes the best and strongest evidence of a child having lived at or about the time it was born. It does not, however, show that a child has been *born alive.* The physical changes in the organs of a child, which result from the establishment of this process take place in the lungs immediately, but in the heart and its appendages more slowly. It is therefore chiefly to the *lungs* that a medical witness looks for proofs of respiration. Sometimes, however, these organs are found in their fœtal condition, or nearly so: — for although a child may have survived its birth many hours, there may be no evidence of the fact from the state of the lungs. To such cases the remarks now about to be made cannot of course apply: — the proofs of life must then be sought for elsewhere, and if none can be found, the case is beyond the reach of medical evidence. But it is obvious that the occasional occurrence of cases of this description can present no objection to our still seeking for proofs of life in the state of the lungs, any more than the fact of poison not being always discovered in a poisoned subject would be a bar to our seeking for the proofs of poison in every unknown case which presented itself. It is the more necessary to insist upon this point, because some have held, that, as we cannot always derive proofs of life from an examination of the lungs of new-born children, we should abandon all evidence of this description, and leave the case in its original obscurity. The very object of medical jurisprudence is, to endeavour to remove these difficulties, and to show in every department of the science, the degree to which we may safely trust the medical proofs of crime, however insufficient, inconsistent, or contradictory they may at first sight appear.

Examination of the lungs.—Some have pretended that the fact of respiration having been performed, would be indicated by the *external configuration of the chest.* Thus it is said, before respiration the chest is flattened, while after that process it is arched in front. The diameters of the cavity have also been measured, and certain comparisons instituted, (Daniel,) but these experiments have been attended with no practical results, and have long been abandoned by medical jurists. Admitting that such a visible change of form is occasionally produced by respiration, it is obvious that in these cases, experiments on the lungs may be readily made; and on the results of these, and not upon minute changes in the capacity of the chest, would a medical opinion be based. The cavity of the chest may be conveniently laid open by carrying incisions from below the clavicles downwards on each side from about half the length of the ribs backwards. The diaphragm may be separated from the cartilages without opening the abdomen; the ribs sawn or cut through, and the flap formed by the anterior parietes of the chest turned upwards. If the child has *not respired*, the following appearances will be seen. The thymus gland, as large as the heart, occupies the upper and middle portions of the cavity; — the heart in its membrane (pericardium) is situated in the lower and middle portion, and is rather inclined to the left side. The lungs are placed quite in the back part of the chest, so as often to give the impression that they are wanting. In some instances they project slightly forwards by their anterior margins, but in no instance unless congested, infiltrated, or otherwise diseased, do they cover and conceal the heart. The thymus gland is sometimes of a pale fawn — at others of a deep livid colour: but there is no perceptible difference in this organ in new-born children, before or after the performance of respiration. On the other hand, when the child has *fully respired*, the most striking differences will be observed in the colour and prominence of the lungs. They are of a light red hue, project forwards — appear to fill the cavity of the chest, and cover, and in great part conceal by their anterior margins, the heart and its membrane. We may meet with every variety in the appearances between these two extremes: for the process of respiration often requires a considerable time in order that it should be *fully* established, especially in those children which are of a weakly constitution or prematurely born. Hence the lungs will be found to occupy their respective cavities to a greater or less extent, and to cover the pericardium more or less, not according to the length of time which a child has lived, but according to the perfection with which the process of respiration has been performed. It will be seen hereafter, that although, as a general rule, the lungs are more perfectly filled with air in proportion to the time during which a child survives its birth, yet this is open to numerous exceptions. It will next be necessary to give particular attention to certain other physical characters presented by the lungs.

Colour of the lungs.—The colour of the lungs *before respiration* is of a bluish red, or deep violet, but it is subject to slight variation. Some medical jurists have compared it to the colour of the spleen. It is important to remark, that a very short exposure to air will materially alter the colour, so that it should be observed and recorded immediately on opening the chest. *After respiration*, the lungs acquire a light red hue in proportion to the degree in which the process has been performed. If imperfectly established, they will be mottled, generally about the anterior surfaces and margins, the patches of light red being intermixed with the livid fœtal hue, and being slightly raised, as if by distension, above the general surface of the organs. The light red tint changes, after a short exposure to air, to a bright scarlet. This change in the colour of the lungs is not a necessary, nor is it an invariable consequence of a child having lived after its birth. I have known a child to live twenty-four hours respiring feebly, and on examining the body, the colour of the lungs was identical with that of the organs in the fœtal state. The change of colour is then a usual, but by no means a necessary consequence of the enjoyment of life: — so that the retention of the fœtal colour does not furnish positive evidence of still birth. Again, the circumstance of the lungs having a light red colour is not an infallible criterion of the child having lived and breathed; for the artificial introduction of air by a tracheal tube, or otherwise, in the attempt to resuscitate a still-born child, is attended with the same physical change. In the course of numerous experiments, purposely made, I have found no appreciable difference. Bernt says, that artificial inflation will not produce a scarlet red colour in the organs, and therefore that this is a criterion of respiration. (Ed. Med. and Surg. Jour. vol. 26, p. 367.) I have not only observed this colour to be absent after respiration, but have actually produced it by artificial inflation in the lungs of a dead child.

2. *Volume of the lungs.*—The difference in the relative situation of the lungs before and after respiration, has been already described. This difference depends entirely upon the increased volume or dilatation of the organs, arising from the introduction of air. *Before respiration*, the lungs are in general scarcely visible, unless forcibly drawn forwards in the chest. When respiration has been perfectly accomplished, the volume is so much increased, that the bag of the heart (pericardium) is almost concealed by them. Respiration must, however, have been very perfectly performed in order that this condition should exist to the full extent described; but I have known the lungs to acquire a considerable volume in a healthy and vigorous child from only two or three respirations. The child was destroyed by craniotomy, and died before it was entirely delivered. In other instances a child may live for one or two days, and the volume of the organs be but little altered. Schmitt has remarked, that the lungs have sometimes a considerable volume before respiration. I have met with this in more than one instance; but this condition will probably be found in general to depend on disease. As the altered volume of the healthy lungs depends on the introduction of air, the effect is the same, whether the air be derived from respiration, from artificial inflation, or generated by putrefaction. Other circumstances must therefore be considered, before we draw an inference from this physical change.

3. *Consistency of the lungs.*—The lungs, *before respiration*, feel like the liver, or any other of the soft organs of the body. They are firm under the finger, but their substance may be lacerated by violent compression. *After respiration* has been fully performed, there is a distinct sensation of what is termed crepitus on compressing them, *i. e.* air is felt within them. This condition of the organs must, of course, depend on the degree to which respiration has been carried. The lungs of children that have lived for a considerable time after birth, will sometimes give no feeling of crepitation under the finger. Generally speaking, lungs of this kind present the other fœtal characters:—thus they are small and of a livid colour. There are, however, cases in which the lungs may have the light red colour of respiration, and be actually much dilated in appearance, yet no feeling of crepitus will be perceptible on pressure. This character, therefore, is by no means a necessary accompaniment of the other two. Crepitation furnishes a presumptive evidence of respiration; but it may be equally met with in lungs that are putrefied, or which have received air by artificial inflation. The cha-

racters here described are seldom found in the lungs of children that have been born prematurely, although these children may have lived some time after birth. They depend on respiration; and, in the exceptional cases referred to, this process is only slowly established.

4. *Absolute weight of the lungs. The static test.* — It is generally admitted by medical jurists, that the weight of the lungs before respiration, is less than that which they have after the establishment of the process. From this an inference has been drawn that the absolute weight of the lungs in an unknown case, compared with certain averages, will aid the inquirer in ascertaining whether respiration has or has not been performed. In order to determine the weight of the lungs, these organs should be carefully separated by dissection from the heart and thymus gland, and removed with the trachea and bronchi attached. Previously to their removal, ligatures should be placed on the pulmonary vessels, so that no blood may escape from the lungs. They should now be weighed, and the weight accurately noted in grains. In taking this weight it does not appear necessary to make any distinction founded on the sex of the child, or on the difference of weight in the two lungs: the only exception would be, perhaps, in relation to twin children imperfectly developed. The average weight *before respiration*, derived from nine cases, was found to be 649 grains. According to Dr. Traill, the weight varies from 430 to 600 grains. It is of importance, in taking the weight of these organs, to be certain that the child is at or near maturity, and that it is of or about the average size and weight: owing to a neglect of this rule, it is highly probable that comparisons have been made of the absolute weight of the lungs in children of different ages, which a full statement of the facts would not have justified. If it be immature, or unusually large, the lungs will weigh either less or more than the average. The average weight of the lungs *after respiration*, derived from three cases, was 927 grains: but in making an estimate of this kind much will depend upon the degree to which respiration has been carried. In three cases, in which the children lived half an hour, six hours, and twenty-four hours respectively, the process had been so imperfectly performed, that the lungs varied but little in weight from the average before respiration. (G. H. Rep. No. V.) The truth is, we cannot compare the lungs of children, as to weight, according to the *time* which they may have survived birth, but rather according to the *degree* to which the lungs have been penetrated by air. In one instance of alleged infanticide, where a child was probably killed soon after birth, the lungs weighed 1000 grains. In another instance, where the child had certainly lived eight or nine days, the lungs weighed only 861 grains. In the first case, respiration had been perfectly per-

formed; in the second, imperfectly. Hence, to say that the lungs weigh so much *after* respiration, amounts to nothing, unless we can estimate, by a sight of the organs, its degree: and any calculation founded upon such dissimilar cases, must unavoidably lead to error. This increase of weight after birth is commonly ascribed to the altered course of the blood under the establishment of the respiratory process, as well as to the fact, that more blood circulates through the lungs after, than before respiration. Practically, this view is confirmed by the contraction of the ductus arteriosus, and the simultaneous enlargement of the pulmonary arteries; changes which have been occasionally observed when the child had survived its birth for only a very short period. As these normal changes in the duct depend on the establishment of respiration, so we cannot expect to find them when the process has been imperfectly performed, although the child may have lived several days.

Weight of the lungs increased by respiration.—It appears to me that the general opinion on this subject is correct, namely, that the healthy lungs of mature new-born children become heavier after respiration, and according to its degree; and where a deviation from this rule is observed, it may probably be explained by the circumstance that the lungs of an immature have been compared with those of a mature child, the lungs of an undeveloped twin with those of one not a twin, or the lungs of one which has breathed imperfectly, with those of another in which respiration has become well established. In this respect the extensive tables drawn up by Lecieux are liable to lead to erroneous inferences relative to the effect of respiration on the absolute weight of the lungs. The weights of the organs are noted, but the *degree* to which respiration had been performed is so loosely stated, as to allow of no fair inference of the effect of this process upon the weight. The time which the children survived is stated; but this, as it is very well known, furnishes no criterion of the degree to which respiration has been carried. Again, we are not informed whether due care was taken to ascertain if the lungs were healthy or diseased. (Considérations sur l'Infanticide. Paris, 1819.) The following table of the weight of the lungs, in four cases, will show how much the organs are liable to vary in weight after birth, according to the *degree* of respiration.

Case 1.	Born dead	Weight,	687	grs.
2.	Lived 6 hours	,,	774	
3.	Lived 24 hours	,,	675	
4.	Lived 9 hours	,,	861	

Relying upon a table of this kind only, without comparing the other characters of the lungs with the weight, it might be inferred that the organs would weigh less in a child which had survived its birth twenty-four hours, than in another which had been born dead, and that there would be very little difference in the weight, whether the child lived six hours or nine days; but when it is stated, that in Case 3 the lungs had every fœtal character possessed by those in Case 1, and that in Case 4 respiration had been obviously very imperfectly performed, the difficulty is removed. Such cases should rather be compared with the lungs in the fœtal than in the respired state. They merely show what is very well known to, and admitted by, all medical jurists, that there are some instances in which the fact of respiration cannot be determined by the application of the static, or any other test, to the lungs. But this is certainly no valid reason why evidence from this source is to be rejected in all other cases. It may be fairly granted that the weight of the lungs of some children that have outlived delivery may not come up to the weight assigned to those of children that have breathed; because, as we have seen, children may survive birth many hours without the process of respiration being properly established. On the other hand, as in Chaussier's observations, the lungs of the still-born may be sometimes as heavy as those of children that have respired; but since the lungs of the still-born would contain no traces of air, the weight above the average in these cases could not be assigned to respiration. Among such subjects, whatever might be the weight of the lungs, if the facts were unknown, it would be impossible to say whether the children were born living or dead. (See Ed. M. and S. J. vol. 26, p. 375.) Increased weight, therefore, is only one among several circumstances to which a medical jurist should attend.

We must not fall into the error of supposing that the lungs increase in weight according to the length of time which a child survives its birth; it is within the limits of a few days, according to the degree of perfection with which a child breathes: hence we may meet with cases of children born alive, surviving some hours or days, and yet after death the lungs will retain their fœtal weight. This is the case in immature children, in most twin children, and in those which are mature but weakly. Among many instances that have come to my knowledge, no difficulty of this sort, however, has occurred. The signs of respiration have been sufficiently well developed to justify a medical opinion, although the child had probably not survived its birth above a few hours, or even minutes. (G. H. Rep. April 1842). The cases of imperfect respiration above alluded to rarely go beyond a coroner's inquest, for want of clear evidence of life. There may be a difference of opinion as to the relative number of instances of perfect and imperfect respiration in new-born children: but a case is never likely to proceed to trial, unless the signs of this process are well marked; and thus many charged with murder must escape, through the want of sufficient medical evidence to establish the fact of respiration and life.

It is scarcely necessary to observe, that the air which the lungs receive by respiration cannot add to their absolute weight. This is because they are in the condition of a bladder, which weighs the same whether it be filled with air or empty. The increase of weight is solely due to the additional quantity of blood, which, owing to the altered course of the circulation, permeates their structure. Hence it follows that when the lungs are distended with air, either from artificial inflation or from putrefaction, the fœtal weight will remain unaltered; and by this means, it is contended, we may distinguish lungs that have respired from those which have been artificially inflated. Orfila states, that the fœtal lungs weigh more before they are artificially inflated than afterwards, — a circumstance which may depend upon the fact that the impulse employed in inflation may have forced out a portion of blood or other liquid. In carefully performing this experiment, I have found that there was not even the least fractional difference, but that the inflated lungs weighed precisely the same as in the uninflated state. From what has already been said, it follows that *great weight of the lungs can obviously furnish no proof of respiration*, unless this be accompanied by the other physical changes indicative of that process, — as, for example, *great increase in volume from the presence of air and crepitation.* If the lungs be very heavy, and at the same time contain little or no air, it is certain that the increase of weight must depend upon disease or other causes,—not upon respiration. In one case which I had to examine, the lungs were large, and weighed upwards of 1200 grains. They contained no air; when divided into thirty pieces, not one portion floated, nor could any air be seen on the closest examination. It was therefore clearly impossible to ascribe a weight so much above the average to the effects of respiration. It must not be forgotten that all the physical characters presented by lungs that have respired are liable to certain fallacies; but, as in the evidence derived from tests used in poisoning, these may be removed, or the force of the objection diminished, by not basing an opinion on one or two conditions only. We must take the whole combined; for it would be as wrong to regard great weight in the lungs *taken alone* as an absolute proof of respiration, as it would be to draw the same inference from a mere change in the colour, volume, or consistency of the organ. This is in accordance with the view adopted by the late Professor Orfila. (Méd. Lég. 1848, vol. 2, p. 229.)

5. *Test of Ploucquet.*— This so-called test for determining whether or not the act of respiration has taken place, was proposed many years since by M. Ploucquet. It is founded on a comparison of the absolute weight of the lungs with the weight

of the body of a child. Admitting that the lungs increased in weight from the establishment of the respiratory process, it was supposed that a like difference would take place in the relative weight of these organs to the body; and that the ratios thus procured, compared with certain averages, would enable a medical jurist to determine, in an unknown case, whether or not a child had respired.

Ploucquet conceived that the average ratio of the weight of the lungs to the body, in children which had not breathed, was 1 : 70; and in those which had breathed, 2 : 70 or 1 : 35. Subsequent researches, however, made by Chaussier and others, have shown that these numbers cannot be considered to represent the true average. The most serious objection to the employment of this test, in cases of infanticide, is, that the lungs and the body are liable to vary in their relative weights, in children of the same age; and *à fortiori*, this variation must exist to a greater extent among children which have reached different ages. There may be various degrees of development in the body of a child, without any necessity existing for a corresponding development taking place in the lungs. It is unnecessary to enter into speculations relative to the causes: experience has shown that such variations really exist; and all that a medical jurist has to consider, is whether the difference can be reduced within limits which may make the test available in practice. M. Devergie states from his experiments, that Ploucquet's test affords no satisfactory results, when applied to the bodies of children that have not reached the eighth month of gestation. According to him, the ratio is, for the Eighth month — Before respiration, 1 : 63; after respiration, 1 : 37; Ninth month — Before respiration, 1 : 60; after respiration, 1 : 45. The ratio, he observes, becomes higher after respiration, in proportion to the perfection with which the process has been carried on. (Médecine Légale, vol. 1, p. 556. See also Ann. d'Hyg. 1835, vol. 1, p. 485; Med. Gaz. Nov. 1842, p. 208.) The facts which have been collected by different observers appear to me to show that Ploucquet's test is not fitted to determine, in an unknown case, whether a child has breathed or not.

6. *Blood in the pulmonary vessels.*—It has been asserted that if blood be found in the pulmonary vessels of a new-born child, we are justified in assuming that respiration has taken place. On the other hand, the absence of blood from these vessels has been considered to prove that a child has not respired. This assertion must have originated in a want of correct observation. The pulmonary vessels contain blood, both in the child which has, and in that which has not, respired. It is possible that the vessels may contain more after respiration than before: but in most cases of infanticide it would be difficult to found any distinction on a point of this nature. In examining the bodies of children

that have died without respiring, and those of others that have lived and respired for some time after birth, no perceptible difference was found in the quantity of blood existing in the vessels in the two cases. The fact is, the excess of blood after the establishment of respiration, is distributed throughout the minute capillary system of the lungs: it does not remain in the large trunks. The state of the pulmonary vessels, therefore, furnishes no evidence either of respiration or the contrary. The same observation will apply to the presence of blood in the substance of the lungs. It is said that on cutting through lungs that have breathed, the incisions are followed by a copious flow of blood; this, it is alleged, does not happen with lungs that have not breathed. In performing this experiment on several occasions, I have not been able to perceive any well-marked difference. The blood in the new-born child may be found coagulated or not, and there is no difference in this condition, whether it is born living or dead.

7. *Relative proportion of fat in the lungs.*— In July 1847, a memoir was presented to the Academy of Sciences by M. Guillot, in which the author proposed to determine the question of respiration by the relative proportion of fat contained in the lungs before and after birth. According to M. Guillot, the quantity of fat contained in the pulmonary tissue is always greater before than after respiration, and it begins to diminish from the moment that the act of breathing commences. Before respiration, the dried lungs yield from ten to eighteen per cent. of fat: after respiration, not more than six per cent. The process followed by M. Guillot is to dry the organs at a high temperature, so as to expel all the water,—reduce them to powder, and digest this powder in ether. (Comptes Rendus, Julliet 12, 1847, p. 777.) It need hardly be observed that this process could not be made available in practice. Admitting the facts as stated, the assigned difference between six and ten per cent. may disappear by further observations. A want of chemical accuracy might lead to serious mistakes. The process, however, is open to this objection:—if respiration has been fully performed, this will be sufficiently evident from the state of the lungs; and if imperfectly performed,—as the change is alleged to depend on the respiratory act, the result of an analysis would not remove the difficulty.

8. *The specific gravity of the lungs.*— The specific gravity of the lungs is greater before than after respiration; for although the organs become absolutely heavier by the establishment of the process, this is owing, not to the air, but to the additional quantity of blood received into them. The air thus received, so increases the volume of the lungs, as to more than counteract the additional weight derived from the blood, and thus apparently to diminish their specific gravity. Under these circumstances

they readily float on water. From several experiments, I have found that the specific gravity of the lungs before respiration, *i.e.* in the fœtal condition, varies from 1·04 to 1·05. They are about one-twentieth part heavier than their bulk of water. After respiration, the specific gravity of the lungs with the air contained in them, I found in one experiment to be 0·94; *i.e.* the organs were about one-seventeenth part lighter than their bulk of water. The introduction of a small quantity of air will render these organs buoyant in water; and an alteration in the volume of the lungs sufficient for this purpose would not be perceptible to the eye. It will be understood that the specific gravity of the substance of the lungs is unchanged; the organs are rendered only apparently lighter by the air contained in their cells, on the same principle as a distended bladder. Hence it follows, that the same apparent diminution of specific gravity will take place whether the air be derived from respiration, artificial inflation, or putrefaction. It is on this property of the lungs that the application of what is termed the *hydrostatic test*, or the *docimasia pulmonaris*, is founded,—a subject which may be appropriately considered in another chapter.

Conclusions.—The general conclusions which may be drawn from the contents of this chapter are:—

1. That a child may be born alive and be criminally destroyed before it has breathed.

2. That the presence of any marks of putrefaction in utero proves that the child must have come into the world dead.

3. That the characters accompanying certain marks of violence may occasionally show that the child was living when the violence was applied to it.

4. That there are no certain medical signs, by which a child which has not breathed, can be proved to have been living when it was maltreated.

5. That a new-born child may be destroyed by the prevention of respiration during delivery.

6. That the proof of respiration shows that the child has *breathed*; not that it has been *born alive*.

7. That by taking together the colour, volume, consistency, absolute weight and buoyancy of the lungs, we may be able to draw an inference whether the child has or has not respired.

8. That the lungs increase in weight according to the degree to which respiration is established, and not necessarily according to the period which the child has survived birth.

9. That no reliance can be placed upon the test of Ploucquet, or the proportionate weight of the lungs to the body.

10. That no reliance can be placed either upon the relative quantity of blood in the pulmonary vessels, or upon the relative proportion of fat contained in the pulmonary tissue, as evidence of respiration having been performed.

CHAPTER 41.

MODE OF EMPLOYING THE HYDROSTATIC TEST—INCORRECT INFERENCES—SINKING OF THE LUNGS FROM DISEASE OR ATELECTASIS—LIFE WITH PARTIAL DISTENSION OF THE LUNGS—LIFE WITH PERFECT ATELECTASIS OR ENTIRE ABSENCE OF AIR FROM THE LUNGS — HYDROSTATIC TEST NOT APPLICABLE TO SUCH CASES—ERRONEOUS MEDICAL INFERENCE FROM SINKING OF THE LUNGS—FLOATING OF THE LUNGS FROM EMPHYSEMA AND PUTREFACTION—EFFECTS OF PUTREFACTION IN AIR—GENERAL CONCLUSIONS RESPECTING THE HYDROSTATIC TEST.

Mode of employing the hydrostatic test. — The hydrostatic test has been long known, and various opinions have been entertained relative to its efficiency and value. Many of the objections that have been urged to its use, appear to have arisen from a mistaken view of the evidence which it is capable of furnishing. The term "test" is decidedly improper, since there are numerous cases in which it does not enable us to decide whether a new-born child has come into the world living or dead. It is, however, for the sake of convenience, here retained. When the hydrostatic test is properly applied, and with a full knowledge of the exceptions to which it is exposed, it may afford in many cases good evidence whether a child has or has not respired. The mode of performing the experiment is extremely simple. Having removed the lungs from the chest, they should be placed, still connected by the trachea and bronchi, upon the surface of distilled or river water. If they sink it should be noted whether the sinking takes place rapidly or slowly. If they both sink, the two lungs should be tried separately; for it is sometimes found, that one, commonly the right, will float, while the other will sink. Supposing that both lungs sink, it will then be proper to divide each into twelve or fifteen pieces, and place these pieces separately on water. If, after this, they all sink, the inference is, that although the child may have lived and survived its birth, *there is no evidence of its having respired.* On the other hand, the organs when placed on water may float: it should then be noticed whether they float high above the surface, or at or below the level of the water; sometimes they indifferently float or sink. These differences will lead to a conclusion respecting the degree to which respiration has taken place. It will now be proper to separate the lungs, and determine whether the buoyancy is due to one or both. Each lung should be divided, as before, and each piece separately tried. If all the pieces float, even after firm compression, we have good evidence, *cæteris paribus*, that respiration has been very perfectly performed. Should any of the divided portions sink in water, either before or after compression, our opinion may be modified accordingly. Some have recommended that the lungs should be placed on water with the heart and thymus gland attached; but there appears to be no good reason for this, since it is as easy to form an opinion of the degree of buoyancy possessed by the lungs, from the readiness with which they float, as by observing whether or not they have the power of supporting these two organs.

Incorrect inferences.—Such, then, is the method of employing the hydrostatic test in cases of infanticide. With regard to its use in medical jurisprudence, it should be observed that the floating of the lungs in water is not, as it is often incorrectly represented to be, a proof that a child has been *born alive*: nor is the fact of their sinking in water, any proof that a child was *born dead.* The floating, under the limitations to be now described, proves only that a child has *breathed*; the sinking, either that it has *not breathed*, or breathed but imperfectly. The fact of a child having been *born* living or dead, has, strictly speaking, no relation to the employment of the hydrostatic test. There are, indeed, cases of infanticide which may be readily established without resorting to this test: all that the law requires is proof of a child having been born living,—whether this proof be furnished by the state of the lungs through the hydrostatic test, or in any other manner, is of no moment. The signs of life are commonly sought for in the lungs, because it is in these organs that the changes produced by a new state of existence are first perceived; but this examination may be dispensed with, when the woman confesses that the child was born alive—when others have seen it manifest life by motion or otherwise after its birth; or, lastly, in cases where, without being seen, it has been heard to cry. The crying of a child has been admitted as evidence of live birth on several trials for infanticide; although, from what will be hereafter stated, it is possible that a child may be heard to cry, and die before its body is entirely born. Among the *objections* which have been urged to the employment of the hydrostatic test, we have first to consider those which concern the sinking of the lungs in water.

SINKING OF THE LUNGS FROM DISEASE OR ATELECTASIS.

It is said that the hydrostatic test cannot show whether a child has or has not survived its birth, because the lungs of children that have lived for a considerable period have been observed to sink entirely in water. In some instances this may depend on disease, tending to consolidate the air-cells, as *hepatization* or *scirrhus*; in others, on *œdema* or *congestion*: but these cases can create no difficulty, since the cause of the lungs sinking in water would be at once obvious on examination.

The hepatized portion of lung may be known by the firmness with which it resists cutting with a knife, as also by the fact that it is impossible to distend it artificially with air. On the other hand, there are cases in which the lungs appear healthy and unaffected: all that we can perceive is, that they retain their fœtal condition. This is a very different state from that of hepatization, because the lungs may, in this case, be made to receive air by artificial inflation. It is remarkable that life should continue for many hours, and sometimes even for days, under such a condition; but the occasional existence of this state of the organs in a living child is placed beyond all dispute;—the explanation of the causes upon which it depends—how it is that a child may live and breathe for hours or days, and no signs of respiration are discovered in its body after death, is, however, involved in great difficulty. The researches of Dr. E. Jörg, of Leipzig, have thrown some light upon the subject: and these may probably lead the way to other discoveries in this obscure department of physiology. Some of Dr. Jörg's views are peculiar. He considers that the act of parturition, as well as the duration of the process, has a material influence upon the system of a child; and that these conditions serve to prepare it for the efforts which it has to make in performing respiration. (Die Fötuslunge, Grimma, 1835.) Supposing the first inspirations made by a child to be, from any cause, feeble or imperfect, then the organs will become only partially distended; the remaining portions will preserve their fœtal condition. Dr. Jörg considers this as a positively diseased state of the lungs in the new-born child, and he has given to it the name of *atelectasis* (ἀτελής, "incomplete;" ἔκτασις, "expansion"). It may proceed from various causes. He considers, that children that are born after an easy and rapid delivery are subject to it; and thus it may be found in a mature, as well as in an immature child. Any cause which much weakens the vital powers of a child before its actual birth, may give rise to the occurrence of this imperfect dilatation of the lungs. In this way it may be due to long-continued pressure on the head during delivery, or to bleeding from the cord. All the causes of asphyxia in a new-born child, will, when operating only in a very slight degree, also produce this atelectasic condition. When only a part of the lung is, in the first instance, distended with air, the child may not afterwards acquire sufficient strength to fill the remaining portions; it may thus live on for some hours or days, respiring at intervals, and becoming occasionally convulsed, in which state it will probably sink exhausted and die. Jörg has remarked, that those portions of the lung which are not speedily distended by air, afterwards become consolidated or hepatized, so that all traces of their vesicular structure are lost. The length of time which a child survives will depend upon the degree to which its lungs have become dilated. This condition of the lungs is sometimes to be clearly traced to the diversion of the blood from these organs, by reason of the ductus arteriosus or foramen ovale remaining open after birth.

Life with partial distension of the lungs. — It is not necessary that the whole of the lungs should have received air, in order that a child should continue to live even for several months after its birth. Some years since, I met with the following case, which will serve to illustrate this statement. A child aged six months, had been, it was supposed, destroyed by suffocation. Upon opening the thorax, the viscera were found healthy; but the whole of the inferior lobe of the right lung was, so far as regarded colour, density, and structure, precisely like the lungs of a fœtus, — no air having ever penetrated into it. It had become developed in size, but its vesicular structure was perfectly destroyed. When the whole of the lung was placed in water, it floated; but when the inferior lobe was separated, it immediately sank to the bottom of the vessel. I have no doubt that this was a case of partial atelectasis, such as is described by Jörg. The lobe had not received air in the first instance; and had become afterwards consolidated or hepatized, so that it could not be inflated. Dr. Albert met with a case, in which a child died *thirty-six hours* after its birth, having been attacked by convulsions at intervals during that time. On inspection the whole of the right and the lower lobe of the left lung were found to be in their fœtal condition, and they immediately sank when immersed in water. There was no diseased appearance in the organs, and the undistended portions were easily filled by blowing air into them. (Henke's Zeitschrift, 1837, vol. 2. p. 422.) M. Dépaul found that in many cases in which children had died suddenly after breathing for several hours or days, there was no other morbid appearance to be perceived than an unexpanded condition of a large portion of the lungs. (Med. Gaz. vol. 39. p. 283.)

Life with perfect atelectasis, or entire absence of air from the lungs. — It is quite necessary for a medical jurist to be aware, that this state of the lungs, which is here called *atelectasis*, is by no means unfrequent among new-born children, although attention has been only of late years drawn to the subject. When no portion of air is found in the lungs of a child, there is no test by which such a case can be distinguished from one in which the child has come into the world dead. These cases of atelectasis are ordinarily set down as exceptions to a general rule; but I believe they are more common than some medical jurists are inclined to admit. In examining the body of a child, the history of which is unknown, it is proper that the possible occurrence of such cases should be well borne in mind. It appears to me not improbable, that many such come yearly before coroners in this country; and that they are dismissed as cases of still-born children, notwithstanding that marks of violence are often found upon the bodies. If, as it has been already observed, the lungs sink in water, this fact alone is commonly regarded as sufficient evidence of still-birth. This is assuredly putting the most humane interpretation on the circumstance, and so far the result is not to be objected to; but we should take care, in carrying out this principle, that we do not throw obstacles in the way of a judicial inquiry, and lead to the concealment of crime. Professor Bernt met with an instance in which a seven-months' child died *two hours* after birth; and when its lungs were divided and placed in water, every fragment sank. Remer has reported another, in which the lungs sank in water, both entire, as well as when divided, although the child had survived its birth at least *four days*. (Henke, Lehrbuch der G. M. p. 374.) In this case the navel-string separated naturally before death. Orfila found, in a child which had lived *eleven hours*, every portion of the lungs, when divided, to sink on immersion. In three other cases, in which the subjects survived birth, four, six, and ten hours, the lungs also sank when divided; two of these were mature children. (Méd. Lég. vol. 1. p. 375.) Dr. Vernon attended a healthy woman, who was delivered of a child at about the *sixth month* of her pregnancy. The child was born before his arrival, and he heard it crying strongly from under the bed-clothes as he entered the room. After removal from the mother, the child cried at intervals, and it was observed that its chest rose and fell as in ordinary breathing. It lived five hours, and it then appeared to die from feebleness and exhaustion. It was a female child and very small; the body weighed two pounds thirteen ounces, and its length was twelve and three quarter inches; the eyelids were adherent; the lungs were of a purplish red colour, and slightly overlapped the bag of the heart. They sank in water both entire and when divided into small pieces: they were not crepitant, and broke down under firm compression:—there was no appearance of air vessels in a section of the lungs when examined by the microscope. The ductus arteriosus and foramen ovale were in their fœtal state. (Lancet, Feb. 3, 1855, p. 121.) In these cases the respiration is what is called bronchial, or confined to the upper part of the air-passages. The following is another instance of atelectasis. The child was born prematurely at the *seventh month*, and cried strongly. The breathing became slower and slower, until the death of the child, four hours after birth; but during this time it cried at intervals. The head and face were livid, and remained so after death. The heart continued to beat after respiration had ceased. The blood on inspection was found fluid and black; the lungs were of a dark colour, like the liver, and they sank in water even after an attempt had been made to inflate them by a blow-pipe. (Med. Times and Gaz., May 23, 1857, p. 523.) Metzger supposed that premature children alone were likely to present this anomaly; *i. e.* of continuing to live after birth without leaving any clear signs of respiration in their lungs.

I may add to these instances, two which have occurred under my own observation. In one, the case of a mature male child. the lungs sank in water, although the child had survived its birth during a period of *six hours*. In the other, the case of a female twin, the child survived *twenty-four hours;* and after death the lungs were divided into thirty pieces: but not a single piece floated; showing, therefore, that although life had been thus protracted, not one-thirtieth part of the structure of the lungs had received from respiration sufficient air to render it buoyant. (Guy's Hospital Reports, No. v. p. 355.) In the latter instance no particular remark was made during life respecting the respiration of the child. These cases show most clearly that buoyancy of the lungs is not a necessary consequence of a child having lived and breathed for some time after birth. Probably, had this been a case calling for medico-legal inquiry, the lungs would have been cut to pieces; the sinking of the divided pieces in water, either before or after compression, would have been set down as negativing the act of respiration, and, unless other strong evidence were forthcoming,—the fact of the child having survived its birth. Here, again, we perceive the necessity of not hastily assuming that a child has been *born dead*, because its lungs *sink* in water. There may be no good medical evidence of such a child having lived after birth, but assuredly the mere sinking does not warrant the common and positive dictum, that the child was necessarily dead when born: it would be as reasonable to pronounce, in a question of poisoning, that the fact of an individual having died from poison was negatived by the non-discovery of a poisonous substance in the stomach of the deceased.

Hydrostatic test not applicable to such cases.—It must be apparent, on reflection, that cases of this description are beyond the reach of the hydrostatic as well as of all other tests applied to the respiratory organs; because the lungs do not receive and retain a perceptible quantity of air, although the subjects may have lived some hours. The hydrostatic test is no more capable of showing that such subjects as these have lived, than it is of indicating from what cause they have died. Facts of this kind demonstrate that a passive existence may be for some time maintained under a state of the respiratory process not to be discovered after death. In the opinion of some, these cases form a serious objection to the hydrostatic test: but it is difficult to understand how they can affect its general application,—or why, because signs of respiration do not always exist in the lungs of children that have lived, we are not to rely upon them when they are actually found. Poison is not always discoverable after death in the stomach of a person who has taken it; but this does not prevent a medical jurist from searching for it, and, under proper precautions, relying upon its discovery as evidence of poisoning in another case. These singular instances prove that we are greatly in want of some sign to indicate life after birth, *when the marks of respiration are absent.* Until we discover this, we must, of course, make the best use of that knowledge which lies at our disposal; taking care to apply it to those cases alone to which experience shows it to be safely adapted. In the mean time, the common inference that a child had been born dead because its lungs sink in water, is never likely to implicate an innocent party; it can only operate by sometimes leading to the liberation of the guilty.

Erroneous medical evidence from sinking of the lungs.—From the cases already reported, it is a fair subject of consideration whether a great error is not committed by those medical practitioners who pronounce all children to have been born dead, merely because the lungs contain no air and readily sink when placed on water. This, it is true, is the common opinion, but it is not warranted by observation. We are only entitled to say, in all such cases, that there is *no evidence* of a child having breathed or lived. Many might be disposed to consider it an unnecessary degree of refinement to hesitate to express an opinion that a child was born dead when its lungs sank entirely in water, because certain cases have occurred wherein these characters have been possessed by lungs taken from the bodies of children that have survived their birth many hours. To those inclined to adopt this view I would say, the answer to such a question is of far greater importance in a medico-legal than in a medical light. In the latter case, no responsibility can be attached to the expression of the opinion commonly adopted; in the former case, however, when the question refers to child-murder, a serious responsibility is incurred by a practitioner, and he can only guard himself from unpleasant consequences by basing his evidence on carefully observed facts. If a child can live for six or twenty-four hours without receiving into its lungs sufficient air to allow even one-thirtieth part of their substance to float, it is clear that such a child may be the subject of a murderous assault; and if a medical practitioner, losing sight of this fact, proceed to declare from the lungs sinking in water, that the child *must* have been *born dead,* his assertion may afterwards be contradicted, either by circumstances, by the testimony of eye-witnesses, or by the confession of the woman herself. He will be required, perhaps, to revise his opinion; and he will then find that the fact of the lungs sinking in water is rather a want of evidence of life after birth, than a positive proof of a child having been born dead. It cannot be denied that the sinking of the lungs is a *presumption* in favour of still-birth, but it is nothing more; — it is not, as it is often set down, a direct or positive *proof* of the child having been born dead. There are many cases reported which show that this is not an unnecessary caution. Meckel relates two instances in which the lungs sank in water, but the women respectively confessed that they had destroyed their children: according to the general rule, these children must have been born dead, and no murder could have been committed! (Gerichtl. Med. p. 365.) For other examples of a similar kind I must refer to the following journals: Ann. d'Hyg. 1837, vol. 1. p. 437; also, 1841, p. 429; Henke's Zeitschrift, 1840, vol. 27; Erg. H.; Brit. and For. Med. Rev., Jan. 1842, p. 250. The cases there reported appear to me to convey a serious warning to medical witnesses on the danger of expressing an opinion not strictly warranted by the medical facts, and which must be in such cases merely speculative. A case of some interest in this point of view was communicated to the Medical Gazette, by Dr. Davies, of Hertford. In November, 1847, he was required to examine the body of a child found under suspicious circumstances. It was in a pasteboard-box of small size, with the lid turned inside out, and on the top there was a quantity of mould. The body was found buried in a garden. It turned out on inquiry that there had not been exactly a concealment of birth on the part of the mother, who was an unmarried woman. The body was thirteen inches long from crown to sole; eyelids were adherent; testicles (it was a male child) had not descended; it weighed one pound and three-quarters. It was ascertained that it had been buried a fortnight, which accounted in some degree for the lightness of its weight in proportion to its length, and for a slight peeling off of the cuticle from some parts of the arms: the body looked otherwise healthy. The age was probably about seven months. On examining the lungs, they were found to be quite firm, like the liver: *they sank in water, both wholly and in parts.* The right lung was of a dark brown mahogany colour, but the upper lobe of the left was of *rather a lighter colour* than any other part of the lungs. However, this lobe sank immediately upon being placed on water. The evidence at the inquest proved that the child was not only *born alive*, but that it had lived *ten minutes* at least, and perhaps longer after birth. It appeared that an elderly woman, living close by, was sent for, and when she arrived she found the child, with the placenta attached to it, in the close-stool. She noticed that the child moved its arms: she therefore took it up with the placenta, and wrapped it in flannel. It continued to move its limbs for *ten minutes*, according to her account, *but it uttered no cry.* When the child ceased to move, she divided the cord seven inches from the body, and tied it into a knot. (Med. Gaz. vol. 40. p. 1022.)

It has been recommended that medical jurists should consider as *dead* every child that has not breathed, *i. e. whose lungs sink in water;* but they who give this advice at the same time admit that children may come into the world living without breathing, and the law holds, under the decisions of its expounders, that respiration is only *one*, and not an exclusive, proof of life. In order to establish life, or even live birth, respiration need not always be proved, either in civil or criminal cases. (See *post*, Birth.) A medical jurist would, therefore, be no more justified in asserting that all such children were necessarily born dead, than that they were born living: and in stating what is the plain and obvious truth, it is not possible that his statement can ever be the means of involving an innocent person. It is certain, however, in departing from the truth, and stating what is contrary to well-known facts, that when the lungs of a child sink in water, it is safe and just to consider such child as having been born *dead*, he is incurring the risk of exculpating a really guilty person; for it cannot be too strongly borne in mind, that a woman is not now charged with murder, merely because the lungs of a child float or sink in water, but because there are upon its body marks of violent injuries apparently sufficient to account for the death of a new-born child, or there are strong moral presumptions of her guilt. (See Ann. d'Hyg. 1836, vol. 2. p. 362.)

FLOATING OF THE LUNGS FROM OTHER CAUSES THAN RESPIRATION.

Another series of objections has been urged to the hydrostatic test, based on the fact that the lungs may receive air and acquire buoyancy from other causes than respiration. These causes are two: *putrefaction and artificial inflation.* It was supposed, that the lungs of a still-born child might become emphysematous from a compression of the sides of the thorax during delivery; but it is difficult to understand how in this way air should be extricated from these organs any more than it would be from the liver under similar circumstances. The truth probably is, that what has been described as *emphysema* of the lungs in still-born children was nothing more than partial or imperfect respiration performed during delivery. In examining the bodies of many still-born children, I have never met with any appearance resembling what has been described as a state of emphysema independently of respiration and putrefaction. It may be proper, however, to state, that, according to some observers, emphysema of the lungs may be produced under the following circumstances: —the thorax of the child is compressed in passing the outlet,—the lungs within are thereby compressed; and if this compressing force be suddenly removed, as by the passage of the thorax, the elasticity of the parietes will cause the chest to expand, and air, it is presumed, will enter as a necessary consequence. The simultaneous compression of the abdomen might aid in the entrance of the air. (Lancet, May 20, 1837; also, June 17, 1837.) It is contended that not only may respiration take place during birth, but that even the lungs of a *dead* fœtus may become thus mechanically inflated, and respiration be thereby simulated.

This opinion appears to be founded on an erroneous view of the condition of the thoracic viscera in the chest. The lungs, before air has entered into them, are as dense as the liver. If they are compressed they may become elongated, but when that pressure is removed, they will, if the child be dead, simply return to their original fœtal condition. To suppose that they would expand and receive air, is to suppose that the reaction of the thoracic parietes is greater than the force with which they have been compressed. But what is to carry the thorax of a dead child beyond the point at which equilibrium is restored? Besides, this would not suffice to distend the air-cells, which are yet coiled up, as it were, and condensed. If this view were correct, scarcely a child would be born without having air in its lungs. In experimenting on this subject, I have never observed the least portion of air to enter:—the air-cells of the lungs do not, therefore, appear to be in the condition of spiral strings, which this hypothesis would represent.

Floating of the lungs from putrefaction.—The lungs of a still-born child, when allowed to remain in the thorax, are slow in undergoing putrefaction; but nevertheless, they sooner or later acquire sufficient air to render them buoyant in water. This form of gaseous putrefaction may even take place in the lungs of a child which has died in utero. One instance of the kind is recorded by Dr. Albert (Henke's Zeitschrift, 1837, vol. 2. p. 179), in which the child was cut out of the uterus in a putrefied state, and its lungs floated when placed on water. It has been also alleged, that the formation of air may take place in the lungs from putrefaction, without this being indicated by change in colour, smell, or other properties of the organs: but admitting that this may occur, it can create no difficulty in the investigation.

When the lungs are putrefied, this will be determined, in general, by putrefaction having extended throughout all the soft parts of the body. The organs, according to the degree of putrefaction, will be found soft, of a dark green or brown colour, and of a highly offensive odour: the serous membrane covering the surface will be raised in large visible bladders, from which the air may be forced out by very moderate compression. It has been remarked, that, under the same conditions, gaseous putrefaction takes place as rapidly in the liver, heart, and thymus gland of a new-born child, as in the lungs. We should therefore examine the general conditions of the body; the distension of the lungs with gas from putrefaction cannot be easily overlooked or mistaken for the air of respiration. The answer to any objection founded on the putrefied state of these organs, must at once suggest itself. It is impossible that any well-informed medical witness can expect to obtain satisfactory evidence from experiments on the lungs of such subjects. He should at once abandon the case, and declare that in regard to the question of respiration, medical evidence cannot establish either the affirmative or the negative. The fact of his not being able to give the evidence required, cannot be imputed as a matter of blame to him; because this is due to circumstances over which he has no control. In a case of poisoning, the appearances after death in the viscera may be entirely destroyed by putrefaction; but no practitioner would think of looking for proofs when the circumstances rendered it utterly impossible for him to obtain them.

A case may possibly occur wherein the characters presented by the lungs will be such as to create some doubt whether the buoyancy of the organs is due to putrefaction or respiration, or, what is not unusual, whether the putrefied lungs may not also have undergone the changes of respiration. The facts may be apparently explicable on either assumption. Even here a proper investigation may serve to remove all doubt. (See case by Dr. Francis, Med. Gaz. vol. 37. p. 460.) It has been recommended on these occasions that the witness should lean to the side of the prisoner,—in other words, he should give an opinion, that the child suspected to have been murdered had not respired. This advice is equal to recommending a witness to take upon himself the duty of a jury, and virtually to acquit a prisoner upon a doubt existing in his own mind, in respect to only *one* portion of the evidence adduced against her. The evil effects of following this kind of advice are well shown by a case reported in Henke's Zeitschrift (1843, vol. 1. p. 102, Erg. H.), in which an opinion was improperly given by a medical witness, that the child, the whole of the organs in whose body were in an advanced state of putrefaction, was born *dead*; and the prisoner afterwards confessed that it had been born *living!* This shows that it is always better to leave a doubtful case as we find it, than to express a positive opinion on one side or the other, when this opinion can never amount to more than a conjecture. If a witness were simply to assure the jury, that medical evidence could not solve the question whether the child had lived, —if he were to assert, what is really the fact, that his experiments would not allow him to say whether the child had or had not respired, — it is certain that no innocent person would ever be convicted or a guilty person acquitted, upon his evidence. It is for a jury only to judge of guilt from *all* the circumstances laid before them; but it is assuredly not for a medical witness to prevent further investigation, and put an end to the case, by leaning to the side of the accused when there is really a doubt upon his mind. It is his duty to state that doubt, and leave the decision of guilt or innocence in the hands of the Court.

Conclusions.—The general conclusions which may be drawn from the contents of this chapter, respecting the application of the hydrostatic test in cases of infanticide, are the following:—

1. That the hydrostatic test can only show whether a child has or has not breathed, it does not enable us to determine whether a child has been born living or dead.
2. That the lungs of children that have lived after birth may *sink* in water owing to their not having received air, or to their being in a diseased condition.
3. That a child may live for a considerable period when only a portion of the lungs has been penetrated by air.
4. That a child may survive birth even for twenty-four-hours, when no part of its lungs has been penetrated by air.
5. Hence the sinking of the lungs (whether whole or divided) in water is not a proof that a child has been *born dead.*
6. That the lungs of children which have not breathed and have been born dead, may float in water from putrefaction or artificial inflation.
7. That the lungs as situated in the chest undergo putrefaction very slowly,—that if but slightly putrefied, the air may be easily forced out by compression, and if much putrefied, either the case must be abandoned, or other sources of evidence sought for.

CHAPTER 42.

FLOATING OF THE LUNGS FROM ARTIFICIAL INFLATION. INFLATION DISTINGUISHED FROM PERFECT RESPIRATION—NOT DISTINGUISHABLE FROM IMPERFECT RESPIRATION — DOUBTFUL CASES—RESULTS OF COMPRESSION—IMPROPER OBJECTIONS TO THE HYDROSTATIC TEST—SUMMARY— RESPIRATION BEFORE BIRTH—VAGITUS UTERINUS—RESPIRATION A SIGN OF LIFE, NOT OF LIVE BIRTH—THE KILLING OF CHILDREN WHICH BREATHE DURING BIRTH NOT CHILD-MURDER. GENERAL CONCLUSIONS.

Floating of the lungs from artificial inflation.— It has been alleged that the lungs of a still-born child may be made to assume, by artificial inflation, all the characters assigned to those which have undergone respiration. Thus, it is said, a child may not have breathed, and yet the application of the hydrostatic test would in such a case lead to the inference that it had. It will be seen that the force of the objection goes to attack directly the inference derivable from the presence of air in the lungs. This objection can, it appears to me, be admitted only under one form, namely, as it applies to lungs which have been inflated while *lying in the cavity of the chest.* Any experiments performed on inflation after their removal from this cavity, can have no practical bearing; since in a case of infanticide we have to consider only the degree to which the lungs may be inflated by a person who is fairly endeavouring to resuscitate a still-born child. The difficulty of inflating the lungs of a new-born child is too well known to require to be here adverted to; the greater the violence used, the less likely is the air to pass into these organs, but it rather finds its way through the gullet into the bowels. Dr. Albert, a late writer on the subject, denies that the organs, while lying in the chest, can be so filled with air, either by the mouth or by means of a tube, as to be rendered buoyant in water. In performing this experiment several times, he never found a trace of air in the air-cells; and he contends that medical jurists have begun at the wrong end (den Gaul von hinten aufgezäumt), in endeavouring to seek for answers to an objection, before they had ascertained that such an objection could have, practically speaking, any valid existence. (Henke, Zeitschrift, 1837, vol. 2. p. 390.) M. Depaul has still more recently found that it requires great force to inflate the lungs, and that their resiliency was sufficient to expel the greater part of the air introduced. (Med. Gaz. vol. 39. p. 283.)

Having had several opportunities of examining the lungs of children in which inflation had been resorted to, not for the express purpose of creating an objection to the hydrostatic test, but with the *bonâ fide* intention of resuscitating them, I may here state the results. In some of these instances a tube had been used, and in others the mouth. In the first case it was found on inspection, that only about one-thirteenth part of the structure of the lungs had received air. In the second, no part of the lungs had received a trace of air, although inflation had been repeatedly resorted to; the air had passed entirely into the abdomen. In a third, attempts were made for upwards of half an hour to inflate the organs; but, on examination, not a particle of air was found to have penetrated into them. In a fourth, no air had entered the lungs, and in a fifth, although a small portion had penetrated into the organs, it was readily forced out by compression. In repeatedly performing experiments on dead children, the results have been similar; the lungs, after several attempts, were found to have received only a small quantity of air. Thus, then, it would appear, that the lungs of a new-born child may be inflated *in sitû*, although with some difficulty, and that the quantity of air which they receive under these circumstances is inconsiderable. If the efforts at inflation be continued for some time in the dead body, and the tube be violently introduced into the larynx or trachea, or if the organs be inflated after removal from the chest, with the express intention of causing them to resemble respired lungs, the result is different: but this is not the mode in which the objection can possibly occur in a case of infanticide, — a circumstance which appears to have been strangely overlooked by some of those who have examined this alleged objection to the hydrostatic test. It is not likely that a woman, if able to perform the experiment at all, would be capable of doing more than a practised accoucheur; and the probability is, that she would, in general, altogether fail in the attempt. One case is recorded, in which a woman, recently delivered, is stated to have succeeded in artificially inflating the lungs of her child (Meckel, Lehrb. der G. M. 368: — see also Ed. Med. and Surg. Jour. vol. 26. p. 374); and another, in which this defence was urged on the part of a female, is reported by Dr. Von Siebold, of Gottingen (Henke's Zeitschrift der S. A. vol. 3, 1845.) The child, in this instance, was found with its head cut off, and the lungs contained air. The inconsistency of the woman's statement as to the mode in which she inflated the lungs was clearly proved, and the examiners did not hesitate to give a decided opinion that the air found in the lungs had been derived from the act of respiration, and not from artificial inflation. This case shows that when a theoretical objection of this kind comes to be tested practically it ceases to present any difficulty. It may happen, however, that another person may inflate the lungs, and if the mother has been secretly delivered she may be wrongly charged with murder. (See case, Casper's Vierteljahrsch, 1859, vol. 2. p. 38.) A midwife here attempted to revive the child by breathing into its lungs after its removal from the soil of a privy; but the circumstances of the case were well known from the statement of the midwife. Other instances of inflation are reported by Dr. Dommes, in the same journal, 1860, vol. 2. p. 131.

But let it be admitted that the lungs have been artificially inflated: in this case, they would resemble, by their partial distension with air, and other physical characters, those of children which had imperfectly breathed. Like them, they may float on water; but on cutting them into pieces, some of these would be found to sink. If the pieces be firmly compressed either by means of a folded cloth or between the fingers, they will lose their air and sink; so that in fact there are no physical means of distinguishing artificially inflated lungs from those that have imperfectly breathed. Experiment has repeatedly shown that when respiration has been feeble, and no artificial inflation resorted to, the air may be forced out of the lungs by moderate compression, and the portion so compressed will sink in water. If the compression be produced under water, bubbles of air may be seen to rise through the liquid. The results have been exactly the same when the lungs were inflated artificially as they were lying in the chest. (See Guy's Hospital Reports, No. V., and for some good remarks on this subject by Dr. Christison, see Ed. Med. and Surg. Jour. vol. 26, p. 74.)

Artificial inflation distinguished from perfect respiration.—If respiration has been *perfectly* established, and the lungs are well filled with air, it is impossible so to expel this air by compressing the divided portions of the organs, as to cause them to sink in water. It has been asserted, that it is equally impossible to force the air out of lungs that have been artificially inflated; but it is highly probable that in these cases the lungs had been inflated to a maximum degree when removed from the thorax, a case in which much difficulty is certainly experienced in expelling the air; but this is not the form in which the objection can ever present itself in a case of infanticide. If the lungs are inflated in the ordinary way, *i. e.* while lying within the chest, there is never, according to my observation, any great difficulty in causing them to lose their air by compression,—a result which has been repeatedly demonstrated to the medico-legal classes of Guy's Hospital. Although no reliance can be placed on the effects of compression in cases of *imperfect respiration*, yet it appears to me that when with great weight of the lungs, there is great buoyancy in water, the fact of these organs not losing the air contained in them, and not sinking after firm compression, ought to be considered as a good corroborative proof of a child having breathed. It has been just stated that compression will not extricate air from lungs which have *fully* respired. By this, it is not to be understood that the experiment of compression can only be practically applied, to distinguish respiration in those cases in which a child has lived for a considerable time after its birth. I have found it to succeed, even when a child had lived to make no more than one or two respirations, and had died before it was actually born. In this case, it was found necessary, in order to effect delivery, to destroy the child while the head was presenting. It lived, however, a sufficient time after the protrusion of its head with the greater part of the brain destroyed, to cry loudly for an instant. The general appearance of the body showed that it had attained to the full period of gestation. On opening the thorax, the lungs were seen projecting slightly forwards over the sides of the pericardium. They were of a light-red colour, but not crepitant under the finger. They had the external physical characters which these organs are known to acquire on the first establishment of respiration; but the absence of crepitation proved that the process could not have been perfectly performed. The colour of the external surface was throughout uniform; a circumstance which I have never witnessed in lungs that had been artificially inflated, except when the inflation had been carried to its fullest extent out of the body. Then, however, there is, commonly, distinct crepitation. When removed and placed on water, these organs floated freely; and on being separated, both appeared equally buoyant. Each lung was next divided into sixteen pieces, and every piece floated. In dividing them, it was observed that the colour was uniform throughout their substance; there was no sense of crepitation or crackling under the knife; and the cells, in which the air was diffused, could not be seen. The pieces were then subjected to forcible compression, for some time in a folded cloth. The cloth was ruptured by the force employed; yet on removing the pieces, and placing them on water, they all continued to float. A portion of air had, undoubtedly, been forced out, but not sufficient to deprive any of them entirely of their buoyancy. By this we learn that in some instances two or three respirations only may suffice to stamp upon the lungs characters whereby they may be easily distinguished from those organs that have undergone artificial inflation. The compression was carried to the furthest possible limit consistently with the preservation of the organic structure of the lungs.

It must not be supposed, that, in all children which have lived but a second or two to respire, similar results will be obtained. The respiration of an instant may distend the lungs of one child, as much as respiration continued for several hours would those of another. The time which a child has survived its birth does not allow us to predict to what degree its lungs will be found distended on inspection, or what the results of experiments on these organs will be. A child may have feebly respired, and have died either in a few minutes or hours, or not until many days have elapsed after its birth. There is, of course, no definite boundary between the perfect and imperfect distension of the lungs, but by the latter condition we may understand that state of the healthy organs in which they contain only sufficient air to render them buoyant in water; and from the slight difference in their specific gravity and that of water, a small quantity will suffice for this. In these cases, the colour, volume, and consistency of the lungs are scarcely changed from the fœtal condition. The admission that air may be compressed out of feebly respired lungs by the same means as out of those which have been submitted to artificial inflation, may appear to render compression useless, as a distinguishing sign of artificial inflation; but we must not forget, that other corroborative sources of evidence may be forthcoming. The experiment of compression will, I believe, when properly applied, enable us to distinguish cases of complete respiration from those of artificial inflation of the lungs *in sitû*; and, if for this circumstance alone, it ought to be regarded as an adjunct occasionally useful in these investigations.

Artificial inflation not distinguishable from imperfect respiration.—It must, however, be admitted, that there are no means of distinguishing *feeble respiration* from *artificial inflation*. The physical characters of the lungs will be unaltered; and compression will, in either condition, destroy their buoyancy. In a case of this kind, I apprehend the only course left open to a medical witness is, to state to the jury, that the evidence derived from experiments on the lungs left it uncertain whether the child in question had respired, or had had its lungs artificially inflated. The jury will then know how to return their verdict; for it must be remembered, they have always circumstances, as well as medical opinions, to guide their judgment; and it is upon the *whole*, and not upon a part, of the evidence laid before them, that their verdict is founded. It is singular that this occasional difficulty of distinguishing artificial inflation from respiration, should have been represented as a serious objection to the employment of the hydrostatic test. Even admitting, in the very few instances in which such a defence on the part of a prisoner is possible, that a practitioner is unable to distinguish one condition from the other, this becomes purely a point for the consideration of a jury: it cannot affect the general application of the hydrostatic test. Examples of this sort of difficulty are by no means uncommon in the practice of medical jurisprudence. Many instances might be adduced of medical evidence being rendered doubtful by circumstances wholly independent of the skill of the practitioner, and over which he has had no possible control. In the determination of any single point in a case of child-murder, whether it relates to live birth or the actual cause of death, a doubt may arise; the question relative to the respiration of a child is not exempted from this rule; but it would be the height of inconsistency to contend, that, because certain means of investigation will not always enable us to express a positive opinion, we should never have recourse to them. I presume that in the present day, no practitioner would trust to the floating of the lungs as a sign of breathing, before he had ascertained that the air contained in them could not be expelled by compression. The charge against an accused party is not likely, therefore, to be sustained by medical evidence of the respiration of the child, unless the child have actually respired; but it is possible, that owing to a want of evidence to characterize feeble respiration, a really guilty person may escape upon the bare assumption that the lungs might have been artificially inflated. The mischief to be apprehended is not, then, as it has been often alleged, that the employment of this pulmonary test may lead to the condemnation of an innocent, but rather to the acquittal of a guilty person. This is certainly an unfortunate result; but it is one for which medical science is not yet in a condition to provide an adequate remedy.

In reference to this objection, there are, it appears to me, only two cases which may give rise to some doubt respecting the source of the air contained in the lungs of a new-born child.

Doubtful cases.—1. In the case of a child that has not breathed, the lungs may be disproportionately heavy, weighing nine hundred to one thousand grains, and they may have been artificially inflated in the attempt to resuscitate it. Unless, in this case, the air were expelled by compression, an inference might be hastily drawn, that the child had probably breathed. The error could be removed only by circumstantial evidence: which, however, is generally sufficient to remove a speculative objection of this kind. But unless the fœtal lungs were highly congested, diseased, or of extraordinary size, it is not likely that they would weigh so much as is here supposed. These doubtful cases may always be suspected to exist when, with *considerable absolute weight*, *the lungs contain very little air.* Let us, however, consider what would be its practical bearing on the question of child-murder, supposing the case not to be cleared up by any of the methods above suggested. 1st, The fact of respiration would not be clearly proved because the great absolute weight of the lungs, without their structure being permeated with air, amounts to nothing. 2ndly, Although the proof of respiration might not be made out, this would not show that the child was born dead; for we know that a child may live many hours, and yet no evidence of life may be derived from an examination of the lungs (p. 439, ante). 3rdly, Admitting that there was proof of the child having lived after its birth, whether there were evidence of respiration or not, the cause of death would have still to be made out: and unless this be clearly traced to the wilful and malicious conduct of the prisoner — proofs of which are not likely to be derived from the body of a child whose lungs she has innocently inflated — she must be acquitted. Thus, then, it is difficult to understand how, in the hands of one who has attended to the subject of infanticide — and no others ought to be allowed to give medical evidence — this objection, on the ground of inflation, can lead to any difficulty whatever in practice. Such a case as that which I have here supposed actually occurred to me in June 1842. A male child, weighing upwards of twelve pounds, died during delivery in a difficult labour. It gave no signs of life when born, and there was no pulsation in the cord. Its lungs were artificially inflated in the attempt to resuscitate it. The organs weighed nine hundred and ninety-four grains. They were slightly crepitant and floated on water, but gentle pressure by the fingers caused them to sink. It was clear that the increased weight depended on their great size, and not on any change produced by respiration. They contained but a small quantity of air, which was easily expelled by pressure. In another case, which I examined in June 1847, the child was born dead. The body was well developed, and the lungs weighed 748 grains. These organs were inflated as they were lying in the chest. On moderate compression, when divided, they immediately sank in water.

2. We will now take the converse objection. A child may live and breathe, and its lungs weigh much under the average of respired lungs, *i. e.* about seven hundred grains. In a case like this, unless the air resist expulsion by compression, a converse mistake might be made, and we should pronounce a child that had really breathed and survived birth, to have been stillborn and to have had its lungs artificially inflated. This might happen in numerous cases of imperfect respiration after birth, did we not know that the sinking of the lungs, whether containing air or not, and whether this air be expelled by compression or not, does not necessarily prove that a child was born dead. It can only show, under the most favourable circumstances, that it has either not respired, or respired imperfectly. The sinking of the lungs may take place in a child that has survived birth and has really been murdered; but in such a case there may be no proofs of life; and therefore a person actually guilty of a crime, would be discharged for want of sufficient medical evidence to convict. This, however, could no more justify the entire abandonment of medical evidence in such cases, than it could of general evidence; because this, like evidence which is purely medical, is but too often insufficient to bring home guilt to the really guilty. The objection, therefore, on the ground of artificial inflation, when closely examined, is more speculative than real. Admitting, as some contend, that there is no positive criterion to distinguish this condition from respiration, it is difficult to conceive a case in which the objection could be sustained; and, if sustained, it never could lead, in the hands of proper witnesses, to the inculpation of the innocent: — unfortunately for society, it would only add another loop-hole to the many which, through the necessary forms of law, now exist, for the escape of the guilty.

Results of compression.—It is proper to observe, that the results obtained by submitting the lungs to compression in cases of respiration and artificial inflation, have been very different in the hands of experimentalists equally competent. Some state that they have been able to force out the air in both instances, — others in neither case. These discrepancies may depend either upon the different degrees of pressure employed, or upon the actual degree of distension of the lungs. The fact of their existence shows, at least, that the lung-tests cannot be safely trusted in the hands of persons who have not been used to such investigations. It appears to me that there has been a great deal of misplaced discussion on this subject. One case should at least be adduced, in which a woman charged with child-murder has been or can be hypothetically exposed to any risk of conviction from the admission that air cannot by compression be forced out of artificially inflated, or that it can be expelled from respired, lungs. I am not aware that there is a single instance in our law records, of such an objection being raised upon any but merely hypothetical grounds, in opposition to all the circumstances of the case. It might be imagined, however, from the discussions among medical writers on the necessity for certain and infallible means of distinguishing artificial inflation from respiration, that every woman tried for child-murder had made the praiseworthy attempt to restore a still-born child, although circumstances may show that she had cut its throat, severed its head, or strangled it, while circulation was going on! (See case, Prov. Med. Journal, April 23, 1845.) If compression be trusted to as a criterion, without a proper regard to other facts, a practitioner not used to such cases may undoubtedly be easily led into error; but he may be equally deceived if he trust what has been proposed as a substitute for compression—*i. e.* a mere physical inspection of the lungs.

Improper objections to the hydrostatic test. Summary.—In concluding these remarks upon the objections to the hydrostatic test, it may be observed that medical practitioners have differed much at different times in their ideas of what it was fitted to prove. About fifty years ago, it would seem that this test was regarded by some as capable of furnishing evidence of murder! Thus we find Dr. Hunter asking the question, "How far may we conclude that the child was born alive, *and probably murdered by its mother*, if the lungs swim in water?" Later authorities, and, indeed, many in the present day, assert that the test is capable of proving whether a child has been *born alive* or not! From what has already been stated, as well as from the most simple reflection on the circumstances accompanying the birth of children, I think it must be evident that the hydrostatic test is no more capable of showing whether a child has been *born alive or dead*, than it is of proving whether it has been murdered or died from natural causes. The majority of those who have made experiments on this subject have only pretended to show, by the use of this and other tests, whether or not a child has *breathed*,—they merely serve to furnish in many cases good proof of life from the state of the lungs; and slight reflection will render it apparent that in no case are they susceptible of doing more. Even here their utility is much restricted by numerous counteracting circumstances, a knowledge of which is essential to him who wishes to make a practical application of the facts connected with them. (See Ed. Med. and Surg. Jour.

vol. 26, p. 365.) If asked to state in what cases the pulmonary tests are capable of assisting a medical jurist, the answer, it appears to me, would be :—1st. They will clearly show that a new-born child has lived, when, during its life, it has *fully and perfectly respired.* Cases of this description form a certain number of those which come before our Courts of law. To them, the most serious objections are not applicable ; and the few which might be made to the medical inferences are not difficult to answer. 2ndly. They will allow a witness to say, that the lungs must have either received air by respiration, or by artificial inflation. These are the cases in which a child has died soon after birth, and where the respiratory changes are but very imperfectly manifested in the lungs. They probably form the large majority of those that fall under the jurisdiction of the criminal law. It might be considered, that the qualifications in the inference here drawn would neutralize its force ; but it must be remembered, that there are few instances of actual and deliberate child-murder wherein artificial inflation could become even a possible defence for an accused party. So unusual is this kind of defence, that among the numerous trials for infanticide which have taken place in this country for many years past, I have not been able to meet with a single instance in which it was alleged, as an objection to the evidence derived from the buoyancy of the lungs, that the prisoner had inflated them in order to resuscitate her child. The reason is obvious ; had such a defence been attempted, the whole of the circumstantial evidence would at once have set it aside. When, in the suspected murder of an adult, a medical man swears that a fatal wound was such that the deceased might have inflicted it on himself, or that the prisoner might have produced it, he is placing the jury in a position very similar to that in which he places them in a case of child-murder, when he says that the child might have breathed, or its lungs might have been artificially inflated. How would a jury decide in the two cases ? Assuredly, by connecting certain facts with which a medical witness is not concerned, but which may, in their opinion, satisfactorily supply the place of what is defective in his evidence. It is not for him to speculate on the probabilities of respiration, or of artificial inflation ; but it is for them to consider whether an accused party was or was not likely to have resorted to an experiment of this nature. It has been suggested that some person might inflate the lungs of a dead child, in order to raise a charge of murder against its mother ; but this suggestion presupposes a profound knowledge of the difficulties of medical jurisprudence ; and even then the question of *murder* does not happen to depend merely on the presence of air in the lungs. Such a case is very unlikely to present itself; indeed, its occurrence is no more probable than that in poisoning, it should be considered a good defence that some person might have introduced poison into the stomach after death. The circumstances of the case will commonly furnish a sufficient answer to such hypothetical views.

The hydrostatic test ought not, therefore, to be lightly condemned, or rejected upon a speculative objection, which, in nine-tenths of the cases of child-murder, could not possibly exist. Let it be granted to the fullest extent, that a conscientious medical jurist cannot always draw a positive distinction between respiration and artificial inflation, still the jury may be in a situation to relieve him from the difficulty. In short, it would be as reasonable to contend that all murderers should be acquitted because homicidal are not always to be distinguished from suicidal wounds, as to argue that all cases of infanticide should be abandoned because these two conditions are not to be known from each other by any certain medical signs. If juries do frequently dismiss such cases, it is, I apprehend, to be ascribed rather to their great unwillingness to become the means of administering what they consider to be severe laws, than to their want of power to balance and decide on the probabilities laid before them. If the pulmonary tests were wholly set aside, it is easy to conceive what would be the consequences. Thus, let us suppose that a new-born child is found, under suspicious circumstances, with its throat cut: we are called upon to say, that it is impossible for medical evidence to establish whether the child had lived or not, and therefore we are to decline making an inspection of its body. But this would be the same as declaring that child-murder could never be proved against an accused party, and that new-born children might henceforth be destroyed with impunity! It appears to me that conduct of this kind, on the part of a medical witness, would be wholly unwarrantable; for we may sometimes acquire, by an inspection, as great a certainty of respiration having been performed, and therefore of a child having lived, as of any other fact of a medico-legal nature. Cases of poisoning often give rise to greater difficulties to a medical jurist; as where, for example, he attempts to found his opinion of the cause of death on symptoms or the appearances in the dead body. But we may put the question in this light. In the body of a healthy full-grown child, which has but recently died, we find the lungs filling the cavity of the chest, of a light red colour, spongy, crepitant beneath the finger, weighing at least two ounces, and when divided into numerous pieces, each piece floating on water, even after violent compression. Is it possible in such a case to doubt that respiration has been performed? If there is no certainty here, it appears to me that medical experience is but little fitted in any case to guide us in our inquiries. It would be difficult to point out an instance in which an affirmative medical opinion would be more surely warranted by the data upon which it was founded.

Respiration before birth.—It has been already stated that the pulmonary tests are fitted to prove only whether a child has or has not *lived to respire.* Neither the hydrostatic nor any other test can positively show that a child was entirely *born alive* when the act of respiration was performed. As this is a subject which generally gives rise to some discussion in cases of child-murder, I shall here make a few remarks on it:—1st, Respiration may be performed while the child is in the uterus, after the rupture of the membranes;—the mouth of the child being at the os uteri. This is what is termed *vagitus uterinus;* its occurrence, although extremely rare, seems to me to rest upon undisputed authority. 2ndly, A child may breathe while its head is in the vagina, either during a presentation of the head or the breech. This has been termed *vagitus vaginalis.* It is not very common, but it must be set down as a possible occurrence. 3rdly, A child may breathe while its head is protruding from the outlet: in this position, respiration may be as completely set up in a few moments by its crying, as we find it in some children that have actually been born, and have survived their birth for several hours. This is the most usual form of respiration before birth. In the *vagitus uterinus or vaginalis,* the lungs receive but a very small quantity of air; in respiration after protrusion of the head, the lungs may be sometimes found moderately well filled; although never, perhaps, possessing all the characteristic properties of those which have fully respired. The well-known occurrence of respiration under either of these three conditions strikingly displays the fallacy of making this process, as some have done, the certain criterion of uterine life. A child may breathe in the uterus or vagina, or with its head at the outlet, and die before its body is born: the discovery of its having respired would not, therefore, be any sort of proof of its having enjoyed what has been termed "extra-uterine life." (For a well-marked case of this kind, see Med. Gaz. vol. 38, p. 394, and another communicated to me by Dr. Crothers, of Coy, will be found in Guy's Hospital Reports, Oct. 1850, p. 231.) The death of a child which has respired in the uterus or vagina, from natural causes before its entire birth, is a possible occurrence; but its death from natural causes before birth, after it has breathed by the protrusion of its head from the outlet, is, I believe, a very unusual event. All that we can say is—it may take place; but its death, under these circumstances, would be the exception to a very general rule. Oberkamp, in four successive deliveries of the same female, observed that the children breathed before delivery, but died before they were born. A case of this kind also occurred to Diemerbroek. (See Meckel, Lehrbuch der G. M. p. 367; Beck's Med. Jur. vol. i. p. 498; also Ed. Med. and Surg. Jour. vol. 26, p. 374.) The cases reported by Beck, of which there are three, lose much of their value from the fact that the lungs were not examined.

Respiration a sign of life, not of live birth. — The hydrostatic test is only capable of determining that *respiration has taken place*: it cannot show whether this process was established during birth or afterwards. The fact of a child having the power of breathing before it is entirely born, does not therefore constitute the smallest objection to its employment; although upon this ground, we find the use of it, in any case, denounced by many eminent members of the medical and legal professions. Thus, Archbold says, "Very little confidence is placed in this test as to the lungs floating, particularly if the child were dead any length of time before the experiment was made" (Criminal Pleading, 367); Mathews speaks of the test as being "quite exploded" (Digest, 251); and Jervis makes the same remark (On Coroners, 127). It is obvious that most members of the law who have treated the subject have adopted, without sufficient examination, the statements of Dr. William Hunter. This author observes: "A child will commonly breathe as soon as its mouth is born or protruded from the mother; and in that case, may lose its life before its body be born, especially when there happens to be a considerable interval between what we may call the birth of the child's head and the protrusion of its body. And if this may happen where the best assistance is at hand, it is still more likely to happen when there is none — that is, where the woman is delivered by herself." (On the Uncertainty of the Signs of Murder in the case of Bastard Children, p. 33.) Dr. Hunter here exposes, in plain language, the fallacy of trusting to signs of respiration alone, as evidence of a child having been *born* alive. The truth of his remarks is, in the present day, generally admitted; and if, among medico-legal writers, we find some still treating of respiration as a certain proof of live birth, it is from their not having sufficiently considered the probability of a child breathing, and dying before its body is entirely extruded. But we may ask, How does the admission of these views affect a case of deliberate child-murder? A living and breathing child may be wilfully destroyed before its body is entirely born, as well as afterwards; and if the law of England does not contemplate the wilful destruction of a living and breathing child, before its entire birth, as a crime, this omission cannot be imputed as a fault to the medical jurist; nor can it at all diminish the real value of the hydrostatic test as furnishing indisputable evidence of *life*. Most persons might consider the crime of murder sufficiently made out, when the medical evidence showed that a child had lived, and that it was *living* when *criminally destroyed*. If, however, this does not constitute infanticide in law, and evidence be further insisted on, to set forth *where* the child was actually living when murdered — whether half protruding from the vagina, or altogether external to the body of the mother, then the fact of respiration before birth is an objection rather against the principles of the law, than against the test used to determine the presence of life. In a case tried a few years since, in which a child had been found with a ligature firmly tied round its neck, the medical evidence showed clearly that it had breathed; and the whole of the appearances in its body were such as to leave no medical doubt that it had died by strangulation. The judge, in charging the jury, said, "if they were of opinion that the prisoner *had strangled her child before it was wholly born, she must be acquitted of the murder!*" The prisoner was acquitted. However we may regard the question of the utility of pulmonary tests, we must look upon that law as but very imperfectly adapted to its purposes, which makes the proof of murder to rest, not upon the actual and wilful destruction of a living child, but upon the precise moment which a murderer may select for the accomplishment of the crime. Impunity is thus held out to all offenders, who destroy a living child during the act of birth; but there is an additional evil, accompanying the operation of this legal rule, which seriously affects the medical evidence given on these occasions. It would seem, from cases to be presently related, that the law will assume, until the contrary appears from other circumstances, that the respiration of a child, if proved by the best of evidence, was carried on before it was entirely born. Let the witness, then, in a case of alleged infanticide, ever so clearly establish the fact of respiration, and therefore of life, at the time the violence was used, this evidence is not sufficient. He is asked whether he will depose that the child had breathed *after* its body was entirely in the world. Unless he can make this deposition—which, for obvious reasons, he can rarely be in a condition to do – it will be presumed that, although the child had breathed, it came into the world dead. Hence, we perceive, a legal shield is effectually thrown around those who may have been really guilty of destroying their children immediately after birth. Under any moral consideration of the circumstances, it appears to me impossible to admit, that a woman who kills her child in the act of birth is less guilty of murder than she who chooses the moment of its entire expulsion to destroy it; and any such distinction, carried to its full extent, must virtually go to the entire abrogation of the law. It is quite necessary that medical witnesses should know what they are required to prove on these occasions; and the following cases will, perhaps, serve to place this matter in a clear light.

The killing of children which breathe during birth, not child-murder.—In the case of *Rex* v. *Poulton*, good medical evidence was given to show that the child was living when the violence was offered to it. Of three medical witnesses, who were called, the first said in answer to questions put to him: It frequently happens that a child is born as far as the head is concerned, *and breathes*, but death takes place before the whole delivery is complete. My opinion in this case is, that the child had breathed, but I cannot take upon myself to say that it was wholly born alive. The second said that death might have occurred when the child was partly born, if no medical man was present to assist in the delivery. The third witness said,—it is impossible to state when the child respired; but there is no doubt from the condition of the lungs, when they were examined, that the child had breathed: children may breathe during birth. (Chitty, Med. Jur. 412.) The evidence here given shows that the witnesses were intelligent men; and that they had duly reflected upon that which the hydrostatic test is really capable of proving. The judge held that this medical evidence was not sufficient:—"something more was required than to show that a child had respired in the progress of its birth; it must be proved that the *whole body* of the child was brought into the world." (See Mathews' Digest, Supp. 25; also, Archbold, Crim. Plead. 367.) In the case of *Rex* v. *Simpson*, tried at Winchester, in March 1835, Baron Gurney would not allow the case to proceed against a prisoner, so soon as the medical witness stated that the lungs of the child might become distended by the act of respiration during birth. In *Rex* v. *Brain*, it was held that the child must be wholly in the world in a living state to be the subject of murder; and in *Rex* v. *Sellis* (Norfolk Spring Circuit, 1837), Mr. Justice Coltman held, that to justify a conviction for child-murder, the jury must be satisfied that the entire body of the child was actually in the world in a living state, when the violence was offered to it. In relation to an important case of infanticide, tried at the Herts Lent Assizes, 1841 (see Guy's Hospital Reports, April 1842), the learned judge (Parke, B.) thus charged the grand jury: "With respect to all these cases (of infanticide), there is a degree of doubt whether the infant has been *born* alive. The law requires that this should be *clearly proved*, and that the whole body of the child should have come from the body of the parent. If it should appear that death was caused *during delivery*, then you will not find a true bill!" In another (*Reg.* v. *Christopher*, Dorset Lent Assizes, 1845), Erle, C. J. drew a distinction between medical (physiological) and *legal* life. The medical evidence clearly established that the child had respired. It was found with its head nearly severed from the body. Erle, C. J. directed the jury that before they returned a verdict of guilty, they must be satisfied that the child was completely born, that it had an existence *distinct and independent from the mother*, and that it was murdered by her. It was possible the child might have respired without being completely born into the world, and although *this might medically be a live child, it was not one legally.* In law, the birth of the child must be complete. The jury acquitted the prisoner. (Prov. Med. Jour. April 23, 1845.) In another case a medical witness was reprimanded for drawing the inference that the child was born alive, from the application of the hydrostatic test. This case was tried on the Midland Circuit in 1853 (*Reg.* v. *Stevens*), before the late Baron Alderson. The body of the child was taken from a river: it was found in a pillow-case with a stone attached to it. There were several incisions on the throat, and the navel-string had been torn away. The state of the lungs showed that the child had breathed, and it was clearly proved to be the child of the prisoner. The medical witness is reported to have stated during his examination, that he had no doubt that the child was born alive; upon which the learned judge reproved him for his rashness, and inquired whether the appearances which he had observed enabled him to say more than that the child had breathed. The witness admitted they did not, and also that the child might have breathed *before* it was completely born. In his summing up, the learned judge remarked, that "the medical evidence only proved that the child had breathed; but a child may breathe before it is separated from the body of the mother, that is, before it is born, and this child may have died before it was born. We have therefore no certainty of there ever having been a person on whom murder could be committed." The prisoner was acquitted.

From these decisions it will be seen that it is not sufficient for a medical witness to depose, from the state of the lungs, that the child was alive *at or about* the time of its birth; according to the present views of our judges, it is indispensably necessary for him to prove that the child was *born* alive, or that it was living *after* its body had *entirely* come into the world.

Conclusions.—The general conclusions respecting the employment of the hydrostatic test, to be drawn from the contents of this chapter, are—

1. That the artificial inflation of the lungs of a child born dead, will cause them to float in water.

2. That while lying in the chest, the fœtal lungs are not easily inflated, and that the difficulty in inflating them is great in proportion as the child is immature.

3. That lungs artificially inflated in the chest, resemble those organs in which respiration has been only imperfectly established.

4. That in cases of inflation in the chest, hitherto tried, the air may be so far expelled from the divided portions of lung by firm compression, as to cause them to sink.

5. That the same result occurs with lungs in which respiration has been imperfectly established.

6. That when lungs have undergone perfect respiration, the

air cannot be expelled by compression of the divided parts, so as to cause them to sink.

7. That the artificial inflation of fœtal lungs causes no alteration of weight, and as the weight increases in proportion to the degree of respiration, so in healthy lungs, with great buoyancy, there should be great weight if the air has been derived from respiration.

8. That while respiration increases the absolute weight of the lungs, it diminishes their specific weight by leading to the distension of the pulmonary cells with air.

9. That when the lungs are very heavy, and contain but little air, it cannot with certainty be inferred, that respiration has been established. The facts, *cæteris paribus*, may be explained by supposing that the lungs have been artificially inflated.

10. That we should base our judgment of a child having breathed, upon great weight and great buoyancy of the lungs combined,—that the one condition without the other is open to the objection, that the air may not have been derived from respiration.

11. That experiments on fœtal lungs, artificially inflated with air after removal from the chest, have no practical bearing on this inquiry.

12. That the floating of the lungs in water proves, *cæteris paribus*, that a child has breathed either at, during, or after birth: it does not prove that a child was born alive, or that it has died a violent death.

13. That the sinking of the lungs as a result of the expulsion of air from them by compression, does not necessarily prove that the child was born dead. It merely proves that the air contained in them was derived either from artificial inflation, or from the imperfect establishment of the respiratory process.

14. That the hydrostatic test is not applicable to determine the fact of respiration or non-respiration in all cases of alleged infanticide; but that with ordinary precautions, it may be safely employed in the majority of such cases.

15. That a child may breathe before, during, or after birth, but the hydrostatic test will not enable us to say, in the greater number of cases, at which of these periods the act of respiration was performed.

16. That respiration is a sign of life, and not necessarily of live birth.

17. That according to the present state of the law, the killing of a child which breathes *during birth* is not murder.

18. Hence medical evidence is required to show whether a child breathed *after* it was *entirely* born: and whether the act of violence which caused its death was applied to it while so breathing.

These conclusions are here, for the sake of clearness, expressed with brevity. Some of them may appear to require qualification; but, for the circumstances which qualify them, the reader is referred to the contents of the chapter.

CHAPTER 43.

ON THE PROOFS OF A CHILD HAVING BEEN BORN ALIVE—EVIDENCE FROM RESPIRATION—EVIDENCE FROM MARKS OF VIOLENCE—EVIDENCE FROM NATURAL CHANGES IN THE UMBILICAL VESSELS, THE FORAMEN OVALE, AND DUCTUS ARTERIOSUS—CLOSURE OF THE FORAMEN AND DUCT BEFORE BIRTH—EVIDENCE FROM THE DISCOVERY OF FOOD IN THE ALIMENTARY CANAL—DETECTION OF LIVE BIRTH BY THE APPLICATION OF CHEMICAL TESTS TO THE CONTENTS OF THE STOMACH—DEFECTIVE EVIDENCE—GENERAL CONCLUSIONS.

THE great question on a trial for child-murder is, whether the child has been born alive; and in order to answer this it is necessary to consider what are the proofs of *live birth* which are available to a medical witness.

Evidence from respiration.—As a general rule there will be no perceptible difference in the state of the lungs, whether the act of respiration is performed by a child during parturition or after it is born, provided that its death speedily follows its birth. But should we find that this process has been *perfectly established*, *i.e.* that the lungs present all those conditions which have been described as characteristic of full and perfect respiration, there is great reason to presume that the process, even if it had commenced during birth, must have continued after the child was entirely born. This presumption becomes still stronger when the child is immature; for, generally speaking, such children must be born and continue to respire for many hours after birth, in order that their lungs should present the characters of complete respiration. The process is seldom so established before birth as to give to these organs a feeling of crepitation under pressure; the existence of this character should, therefore, be sought for. A witness who relied upon it as a conclusive proof of respiration *after* birth, might be asked by counsel, whether it were not possible for some children to remain so long at the outlet with the head protruding, as to render the lungs crepitant from frequent respiration *before* entire birth. Admitting the bare possibility of this occurrence, he should endeavour to ascertain whether there were any probable causes thus to protract delivery while the head of the child was in this position; as also, what natural cause could have produced its death when its head was protruding, and when respiration had been so freely performed as to give crepitation to the lungs. The presence or absence of the usual scalp-tumour might throw some light upon the case. If, when present, it did not prove live birth, it might indicate protracted delivery, and show that the child had been recently living.

Evidence from marks of violence.—If marks of violence, apparently inflicted about the same time, are found on different and remote parts of the body, and these marks bear the characters of those produced during life, it is rendered probable that the whole of the body of the child was in the world when they were caused. Marks of severe violence on one part, as the head or breech, would not always justify such a presumption, because it might be fairly objected that they had been unintentionally produced by the woman in her attempts at self-delivery, and yet the child not have been born alive. It would be for a witness to form an opinion from the circumstances accompanying the particular case, whether they had been thus occasioned. From this it will be seen that, in making an examination after death, it is proper that every mark of injury on the body of a child should be noted down. In March 1848, I was consulted by Mr. Prince, a former pupil, in reference to a case in which the presumption of live birth rested mainly on the degree of respiration, and the position and nature of certain marks of violence found on the child's body. The child, which was said to have been born dead, was exhumed two days after burial, and eleven days after birth, and the body examined by Mr. Prince. It was full-grown, and not putrefied; the skin pale, and free from lividity. There was a clean cut on the right arm, dividing the membrane (fascia) and muscles, as if made by a sharp instrument. The edges were much retracted, and the whole of the wound was of a florid red colour; but there was no swelling or other marks of inflammation. There was a large vesicle (like the vesication of a burn) on the scrotum, containing three drachms of yellow-coloured serum. On the right leg the muscles were exposed for nearly the whole length: the surface of the wound was of a deep scarlet colour, and the margin widely inflamed. It had the appearance as if fire had been applied to the leg, although there was no sign of charring. These facts tended to show that the child was living when the injuries were inflicted; while the nature and situation of the injuries rendered it impossible that they could have arisen from any accident during delivery. The state of the lungs was somewhat remarkable,—the *left* floated freely in water, and there was distinct crepitation in it: the right sank in water,—no portion of it when divided, was observed to float. From the buoyant and crepitant state of the left lung, there was reason to presume that if respiration had commenced during birth, it had continued afterwards. Mr. Prince therefore inferred that the child had been born alive:—this inference was corroborated by the appearance of the marks of violence. It is probable that the child did not live long after birth. The air could not have been derived from putrefaction or artificial inflation: therefore the only question here was, whether the child had breathed after its body was wholly in the world. The facts above mentioned justified the inference drawn by Mr. Prince. From a confession subsequently made by the female, it appeared that the child had been born alive, and had cried, but owing to the injuries inflicted on it, it did not survive birth longer than a quarter of an hour. Although it is a rare circumstance that one lung should become thus fully distended with air, while the other receives none, cases of this kind are on record. Chaussier met with the *left* lung much more distended than the right in the bodies of children that had survived birth some hours. (Capuron, Méd. Lég. des Accouchemens, p. 411.) The general opinion is, that the right lung receives air more readily than the left, owing to the larger size and more direct course of the right bronchial tube.

Evidence from certain changes in the body.—In a child that has been born alive, or has survived its birth, that portion of the umbilical cord which is contiguous to the abdomen undergoes certain changes: thus it becomes slowly shrivelled, and separates from the body with or without cicatrization. The umbilical vessels are at the same time gradually closed. According to Billard, the obliteration of these vessels is effected in a peculiar manner. The calibre diminishes as a result of the concentric thickening of the coats, so that while the vessel retains its apparent size, its cavity is gradually blocked up. A quill would represent the form of the vessel in the fœtal state, and a tobacco-pipe in the obliterated state. It is only by cutting through the vessel that the degree of obliteration can be determined.

The state of the *umbilical cord* has often furnished good evidence of live birth, when the other circumstances of the case were inadequate to furnish decisive proof. In the following case, for the particulars of which I am indebted to Mr. French, it might have been suspected, but for the state of the cord, that the child had been still-born, and that its lungs had been artificially inflated. The body of the child had been exhumed soon after burial, in consequence of some suspicion respecting the cause of death. It weighed nearly five pounds, and was eighteen inches long; the opening for the navel was exactly in the centre of the body. The hair on the scalp was about an inch in length, and plentiful; the nails reached to the extremities of the fingers and toes. There was no mark of violence about it. The *navel-string had separated* by the natural process, but the skin around was not quite healed. The tendon of one of the muscles of the leg was prominent, and apparently contracted at the instep. The left testicle alone had descended into the scrotum—the right was still in the inguinal canal. This rendered it probable that the child had not quite reached maturity. It was by this peeuliarity of the instep that the body of the child was identified. In the first instance the body of another child had been brought from the same burial-ground, but rejected, from the absence of this appearance of the foot. On opening the chest, the lungs were observed to be situated posteriorly, and not filling the cavity. They weighed together 861 grains—the right weighing 430, and the left 431 grains. The heart, thymus, and lungs were placed together in water, but they immediately sank to the bottom. The lungs when separated from the other organs, floated, but with a slight degree of buoyancy. Indeed, this was established by the fact, that they sank with the heart and thymus attached. The lungs were cut into twenty-two pieces—three from the apex sank; the remaining nineteen pieces floated, and they were not made to sink by pressure. The foramen ovale was but slightly open and contracted, as well as the ductus arteriosus, to about one-half of the fœtal diameter. The bladder was perfectly empty,—the intestines contained only mucus. The conclusions at the inquest were: — 1. That the child had been born alive, and had lived certainly not less than three days, and probably longer.—2. That respiration during that time had been but imperfectly established.—3. That in all probability it had died a natural death. The conclusions were well warranted by the medical facts. Experiments on the lungs were here not absolutely necessary, owing to the state of the umbilical cord. It might have been objected to any inference from the condition of these organs, that the facts were explicable on the supposition of their having been artificially inflated. The case, therefore, furnishes another proof of the ease with which a speculative objection on this ground may be set aside. It was subsequently proved that the child had lived eight days after birth.

These changes in the umbilical cord, when found, clearly prove that a child has survived its birth, whatever may be the results of experiments on the lungs; but the difficulty is, that they require some days for their development, and in practice it is often necessary to procure some sign of survivorship of only a *few minutes*, or at farthest of a *few hours*. The same remark applies to the *exfoliation of the cuticle* in a new-born child: such a condition of the skin can rarely be found in cases of infanticide. The absence of meconium from the intestines, and of urine from the bladder, are not proofs of live birth, for these may be discharged during birth, and yet the child not be born alive.

Evidence from changes in the heart and fœtal vessels. Docimasia circulationis.—It has been supposed that the state of the foramen ovale, ductus arteriosus, and canalis venosus, would aid a medical jurist in forming an opinion whether a child had survived its birth. In general, as a result of the establishment of respiration, it is found that the communication between the auricles of the heart by the foramen ovale becomes closed; and that the two vessels, after gradually contracting, become obliterated, or are converted into fibrous cords. Whatever may be the results of experiments on the lungs, it has therefore been contended, that the closure of the foramen and vessels would infallibly indicate that a child had breathed. This inference, however, has been too hastily drawn. Recent researches have shown, that there are some serious objections to any conclusions based on the state of the fœtal vessels. The entire closure of these parts, as a natural process,— always takes place slowly, and sometimes it is not complete until many years after birth. Thus, then, in the generality of cases of infanticide, in which necessarily the child survives but for a short period, no evidence of the fact will be procurable by an examination of the heart and fœtal vessels.

Ductus arteriosus.—Prof. Bernt, of Vienna, who has made many observations on this subject, has arrived at the following conclusions respecting the period required for the closure of the ductus arteriosus in children which have lived after birth:—1. If a child has lived only a *few seconds*, the aortal end of the duct appears contracted, and the vessel, instead of being cylindrical throughout, acquires the form of a truncated cone.—2. If a child has lived for *several hours*, or a *whole day*, the duct becomes again cylindrical, although shortened and contracted in diameter. Its size is about equal to a goose's quill; it is, therefore, much smaller than its root, and about as large as either of the two branches of the pulmonary artery, which have in the meantime become increased in size.—3. If a child has lived for *several days* or a *whole week*, the duct contracts to the diameter of a few lines,—about equal to a crow-quill, while the two branches of the pulmonary artery are equal in size to a goose's quill.—4. The duct is found perfectly closed and quite impervious, at a much later period; *i. e.* after the lapse of an uncertain number of weeks or even months. Among the exceptional conditions, Bernt remarks, that the contraction may be first observed at the cardiac instead of the aortal end. In one instance of a still-born child, that was resuscitated and breathed feebly for a short time, and in which the thymus gland was absent, the duct was of the size of a crow-quill, as in children which have lived several days. He also states, on the authority of Joseph Schallgrüber, that the duct is sometimes entirely absent. (Das Verfahren bey der gerichtlich-medicinischen Ausmittelung zweifelhafter Todesarten der Neugebornen, von Joseph Bernt, s. 67, Wien, 1826; also, Systematisches Handbuch der gerichtlichen Arzneikunde, s. 275, Vierte Auflage, Wien, 1834.) —The conclusions of Professor Bernt are here given in order to show that the natural closure of the duct is a slow process; but the conclusions are open to many more exceptions than those admitted by the writer. Neither in his works, nor in those of other authorities on medical jurisprudence, is any case recorded which shows that the duct can become quite impervious from natural causes in a child which has lived only a few hours.

Although the closure may take place as a result of the establishment of respiration, it is obvious that the time of its occurrence after birth is so uncertain as to render any evidence derivable from the non-closure altogether fallacious. I have examined the bodies of several children that have survived birth for some hours, and have not been able to discover any perceptible alteration in the diameter of the duct either at its aortal or cardiac end. In other cases partial contraction has been apparent. As the closure depends on a diversion of blood through the lungs, so it follows that, when respiration is feeble or imperfect, the duct will be found either of its natural patency, or, if closed, the closure must be regarded as an abnormal deviation. In the case of a child that died at the age of ten weeks, the ductus arteriosus was found to be freely open. (Med. Gaz. vol. 40. p. 994.) The researches of Dr. Norman Chevers have shown, that there are numerous abnormal conditions which may give rise to non-occlusion of the duct. (Med. Gaz. vol. 36. p. 190, and vol. 38. p. 961; see also Orfila, Méd. Lég. 1848, vol. 2. p. 212.) From the facts collected by Dr. Chevers, it appears that the duct is liable to become contracted and even obliterated, before birth, and before the child has actually breathed. In these cases there has been, in general, some abnormal condition of the heart or its vessels; but this, even if it existed, might be overlooked in a hasty examination: hence the contracted or closed condition of the duct cannot be taken as an absolute proof that a child has been born alive or survived its birth. In January 1847, Dr. Chevers presented to the London Pathological Society, the case of a child born between the seventh and eighth months, in which this vessel was almost closed, being scarcely one-twelfth of an inch in diameter, and capable of admitting only the shank of a large pin. The tissues of the duct had altogether an appearance of having undergone a gradual process of contraction; and its state proved that its closure commenced previously to birth. In fact, the child survived only *fifteen minutes*; while, according to Bernt's rule, the medical inference might have been that this child had lived a week. It is important to remark, that in this case the heart and lungs were in their normal or natural state. (Med. Gaz. vol. 39. p. 205.)

The evidence derivable from the condition of the ductus arteriosus in a new-born child, was submitted to a rigorous examination in the case of *Frith*. (Ayr Circ. Court of Justiciary, Oct. 1846.) This important case was tried before the late Lord Justice Clerk of Scotland, to whose kindness I am indebted for a full and accurate statement of the evidence. The body of the child was found in a bag which had been buried in the sands on the sea-shore at Ayr, a little above high-water mark, with such marks of violence about it, as left no doubt that it must have been deliberately and intentionally destroyed. Independently of severe injuries to the throat externally, the mouth and throat internally were found to be so closely stuffed with tow and other substances, that there was some difficulty in removing them. The body when found was much decomposed; the brain was pulpy, and the cuticle, as well as the bones of the skull, were easily separated. The weight of the body was seven pounds, and the child had the characters of maturity. The prisoner had, beyond doubt, been delivered of a child about three weeks previously to the discovery of this body. It was alleged that this was her child, and she was put on her trial for the murder.

The material question in the case was therefore one of identity. It depended on two sets of facts — ordinary and medical. The bag in which the body was found was part of a cloth-covering of a cushion belonging to the mother and grandmother of the child. This being made out to the satisfaction of the jury, the evidence so connected the prisoner with the dead body, that the medical facts raised in the defence became only of secondary importance. On an inspection of the body the following appearances were met with:— The heart and lungs weighed one ounce; the latter organs were collapsed. The right lung was considerably decomposed, and sank when placed on water; the left was of a red colour, firm in texture, and floated on the surface when immersed in a vessel filled with water; but on pressure there was no crepitation. The right side of the heart was filled with coagulated blood, the foramen ovale being partly open, and the *ductus arteriosus* impervious. The liver was large, and of a leaden hue, the ductus venosus almost obliterated, and meconium was found in abundance in the lower bowels. The reporters were of opinion, from the perfect conformation of the child's body, and the above-mentioned appearances, that it had been born alive. The circumstantial evidence established that no more than *five hours* could have elapsed from the birth of the child to the time at which its body was buried in the spot where it was subsequently found; and that, admitting it to have been born alive, there was the strongest reason to believe that it did not survive its birth more than *ten minutes*. The results of experiments on the lungs were not alone sufficient to show that the child had been born alive. The organs were light, and not crepitant; the right lung was decomposed, and yet it sank in water, while the left was firm, and floated. The defect in this part of the medical evidence was, however (admitting the identity), removed by the evidence of a man lodging in the prisoner's house, who deposed that he distinctly heard the child cry. He slept in the same room with the prisoner on the morning on which she was delivered, and there does not appear to have been any reason to doubt his testimony.

Under these circumstances the defence taken up was, that, considering the state in which the ductus arteriosus was found, this could not have been the child of the prisoner, because, if destroyed after being born alive (which was disputed), it must clearly have been destroyed immediately after birth. In that case the ductus arteriosus could not have been found impervious; *ergo*, the body found was not the body of the prisoner's child. It was contended that, according to all previous experience, the duct could not be found impervious in a child which had ceased to live within a *few minutes*, or even a few hours, after birth. One medical witness for the prosecution admitted that it required some days or weeks for the duct to become impervious: but a case was reported by Beck in which it had closed within a day. Another stated that it is generally a considerable time before the duct becomes closed. Medical evidence was given in defence, to the effect that the earliest case of closure was twenty-four hours, and from the state of the duct in this case, the witness considered that the child must have survived for one day at least, or not much less. Another witness stated that the discovery of the closure in a body would lead him to infer that the child had survived three or four days. According to this evidence the body produced could not have been that of the prisoner's child. The jury, however, found that the child had been born alive, but that murder had not been proven. (For reports of this case, see Med. Gaz. vol. 38, p. 897: and Ed. Monthly Journal, Nov. 1846, p. 385.)

It appears from the evidence given at the trial that circumstances quite irrespective of medical testimony, proved that this child had been born alive, that it was the child of the prisoner, and that it could have survived its birth only a few minutes. The medical evidence left it undoubted that the child had been destroyed by violence. The facts that the mouth and throat were firmly packed with tow, and that there had been copious effusion of blood in the seats of violence, admit of no other explanation. To what, then, is the early closure of the duct in this case to be referred? So far as I am aware, there is no instance on record of the arterial duct becoming *impervious* within a period of five or six hours (in this case only as many minutes could have elapsed) after birth. Its closure is naturally the result of free and perfect respiration in a healthy child: but the state of the lungs in this instance showed that respiration had neither been full nor complete. It is probable, therefore, that the case was similar to that described by Dr. Chevers, and that there was an abnormal condition of the duct. (See *ante*, page 468.) Either this must be assumed, or the closure must depend on other causes than perfect respiration: but experience shows, as a general rule, that it proceeds *pari passu* with this process.

Admitting that this abnormal state of the duct, *i. e.* its closure previous to birth, is in general accompanied by malformation either of the heart or of the great vessels connected with it, yet Dr. Chevers's case already related proves that this is by no means a necessary accompaniment. Hence, considering the serious responsibility attached to a medical opinion in a case of child-murder, the better rule will be to place no confidence on a contracted condition of this duct as evidence either of live birth or of the time during which the child has lived. It can only have any importance as evidence, when the death of a child speedily follows its birth; and these are precisely the cases in which a serious fallacy is likely to arise, for the contraction or closure may be really congenital, and yet pronounced normal. If a child has lived for a period of two or three days (the time at which the duct naturally becomes contracted or closed), then evidence of live birth from its condition may not be necessary: the fact of survivorship may be sufficiently apparent from other circumstances. Hence this species of evidence is liable to prove fallacious in the only instance in which it is required, and the case of Frith shows the dangerous uncertainty which must attend medical evidence based on the closed condition of the duct.

Canalis venosus.—There is not, so far as I know, any instance of the obliteration of this vessel previous to birth. When respiration is fully established, it collapses, and becomes slowly converted in a variable period of time, to a ligamentous cord or band, which is quite impervious. There is no doubt that in those cases in which it is stated to have become obliterated in children that could have survived birth only a few minutes or hours, the collapse of the coats has been mistaken for an obliteration of the canal. It is probably not until the second or third day after birth that its closure begins, although nothing certain is known respecting the period at which it is completed. The condition of this vessel, therefore, can throw no light upon those cases of live birth in which evidence of the fact is most urgently demanded.

Foramen ovale.—This valvular opening in the heart in general becomes closed after the establishment of respiration: but I have found it repeatedly open in children that had survived birth several hours; and, as it will be hereafter stated, the period of its closure is as variable as in the case of the ductus arteriosus. Hence it is not capable of supplying with certainty, evidence of live birth, in those instances in which this evidence is most required. According to Billard, the foramen becomes closed between the second and third days; but there are numerous cases in which it is found not closed at much later periods after birth. Dr. Handyside states that it is more or less open in one case out of eight. In 1838 two subjects were examined at Guy's Hospital, one aged fifty, the other eleven years, and in both the foramen was found open. There is, however, another serious source of fallacy, which must be taken into consideration: the closure of the foramen ovale has been known to occur as an abnormal condition previously to birth and the performance of respiration. One case is mentioned by Capuron (Méd. Lég. des Accouchemens, p. 337). and another, of an instructive kind, is reported in the Medical Gazette (vol. 38. p. 1076). Other instances of this abnormal condition are adverted to by Dr. Chevers (Med. Gaz. vol. 38. p. 967): and it appears that in these the arterial duct remained open. in order to allow of the circulation of blood, not only before, but subsequently to, respiration. The children rarely survive birth longer than from twenty to thirty hours. Dr. Chevers justly observes, that "Cases of this description are of the highest importance in a medico-legal point of view, as they fully disprove the opinion maintained by many anatomists, that obliteration of the foramen ovale must be received as certain evidence that respiration has been established. It is assuredly impossible to deny that in the heart of a child which has died within the uterus, and has been expelled in a putrid condition, the foramen ovale may be found completely and permanently closed. In such cases as these it would, however, probably be always possible to determine, by an examination of the heart and its appendages, that the closure of the foramen had occurred at some period antecedent to birth." It would, therefore, be unsafe in practice to rely upon the closure of this aperture as a proof of live birth, in the absence of other good evidence: and in no case can its patency be regarded as a proof that a child has come into the world dead. Dr. Kidd met with the case of a new-born child, in which a thick layer of lymph had been deposited across the aperture so as nearly to block it up. The ductus arteriosus was completely closed. The child could not have survived its birth more than a few hours (Assoc. Jour. Feb. 4, 1853, p. 104). This deposit of lymph is a condition not usually found. Dr. Peacock considers that the foramen is closed by the contraction of muscular fibres of which the valve is constituted. In a medico-legal point of view, the patency or closure of this aperture possesses no longer any importance. (Assoc. Journal, Feb. 25. 1853. p. 177.)

As a general rule, these peculiar parts of the fœtal circulation are rarely obliterated by a normal process before the eighth or tenth day after birth. The obliteration, according to Bernt and Orfila, takes place in the following order:—1. The umbilical arteries. 2. The canalis venosus. 3. The ductus arteriosus; and 4. The foramen ovale. (Orfila, Méd. Lég. 1848, vol. 2. p. 210.) The circumstances connected with the closure of these fœtal vessels have been statistically investigated by Dr. Elsässer. Among 70 still-born children they were found open in 69. Among 300 children who died soon after birth, 80 out of 108 prematurely born, and living from one to eight days, presented all the passages open:—127 out of 192 infants born at the full time had all the passages open but partly contracted. The ductus arteriosus was open in 55 cases, and completely closed in 10 cases; the canalis venosus was open in 81, and completely closed in 37 cases; while the foramen ovale was open in 47, and completely closed in 18 cases. These facts, according to Dr. Elsässer, prove that the vessels peculiar to the fœtal circulation remain open as a rule for some time after birth, and that it is not possible to determine accurately, by days, the period of their closure. This physiologist remarked that the closure commenced and was often completed in the canalis venosus, before it manifested itself in the other vessels. The complete closure, in by far the greater number of cases, takes place within the first six weeks after birth, and the instances of obliteration before birth, or before the period mentioned after birth, must be regarded as rare exceptions. (Med. Times and Gaz. May 21, 1853, p. 530.)

The result of this inquiry respecting Professor Bernt's *docimasia circulationis* is essentially negative: it either proves nothing, or it may lead the medical witness into a fatal error. It has been the more necessary to point out the serious fallacies to which it is liable, because hitherto medical jurists have been disposed to place great reliance upon it, in cases in which evidence from the state of the lungs was wanting. The necessity of these facts being known is shown by the case which occurred at Ayr (*ante*, p. 469), in which great reliance appears to have been placed upon the following statement by Dr. Beck:—"If, therefore, the ductus arteriosus be found cylindrical in its shape, and not contracted towards the aorta, and if it equal in size the trunk of the pulmonary artery, the inference would be that the child was not born alive. On the other hand, if the ductus arteriosus be contracted towards the aortal end, and if its size be much less than the trunk of the pulmonary artery, the inference would be, that the child had been born alive." (Beck's Med. Jur. 5th edit. p. 251.) From a consideration of the preceding facts, it will be seen that such inferences might seriously mislead a Court of Law.

Evidence from the state of the alimentary canal.—Good evidence of live birth may be sometimes derived from the discovery of certain liquids or solids in the stomach and intestines, such as blood, milk, or farinaceous or saccharine articles of food; for it is not likely that these substances would be introduced or swallowed during parturition, nor is it at all probable that they should find their way into the stomach or intestines of a child which was really born dead.

Starch.—In the case of a new-born child, Dr. Geoghegan discovered, by the application of iodine water, the presence of farinaceous food in the contents of the stomach; hence the question of live birth was clearly settled in the affirmative. In a more recent case, Dr. Francis, of Manchester, employed this mode of testing, with satisfactory results, even when the investigation was beset with unusual difficulties. He was required by the coroner to examine the body of a new-born child found under suspicious circumstances. The examination of the lungs left no doubt that respiration had taken place; and the fact that the child had been born alive. was fully established by the discovery in the stomach of a small quantity of farinaceous food. On digesting a fragment of the pulp found in this organ with distilled water, and adding a drop of a weak solution of iodine. an intense indigo-blue colour appeared immediately. The application of this chemical test, therefore, removed any doubts which might have been entertained on the question of live birth. (Med. Gaz. vol. 37, p. 460.)

Sugar.—In one case which I was required to examine. the presence of sugar was easily detected in the contents of the stomach by the application of Trommer's test. In order to apply this test, a few drops of a weak solution of sulphate of copper should be added to a portion of the concentrated aqueous extract of the contents of the stomach. An excess of a solution of pure potash is then added. and the liquid boiled. If sugar be present, the sub-oxide of copper is immediately precipitated of a reddish-brown colour. With white sugar the same decomposition is effected, but more slowly. If starch be present, black oxide of copper may be thrown down, but there is no reduction. The production of the red oxide proves that some saccharine substance is present.

Milk.—This liquid, or its principle casein, forms a rich violet-blue solution with a few drops of a solution of sulphate of copper, and an excess of caustic potash. The red sub-oxide will be thrown down on boiling, if sufficient *lactine* (sugar of milk) be present. Casein, or the curd of milk, owing to its containing a trace of sugar, acts in a similar manner, but the decomposition takes place more slowly.

Albumen forms a deep violet-blue solution with potash and sulphate of copper, but the red sub-oxide is not precipitated on boiling. Either there is no effect, or if the caustic potash be in large quantity, the black oxide falls down. An instance is related by Dr. Döring in which a spoonful of coagulated *blood* was found in the stomach of a new-born child. The inner surfaces of the gullet and windpipe were also covered with blood. Dr. Döring inferred from these facts, that the child had been born alive; for the blood, in his opinion, must have entered the stomach by swallowing, after the birth of the child, and while it was probably lying with its face in a pool of blood. (See on this subject Henke's Zeitschrift, 1842, vol. 2. p. 219.)

In forming a judgment in a doubtful case, a question may arise whether any and what substances naturally exist in the stomach of a fœtus born dead. Dr. Robinson has drawn the following conclusions from his observations on the stomachs of two human fœtuses, and on those of the calf, lamb, and rabbit: —1. That the stomach of the fœtus, during the latter period of its uterine existence, invariably contains a peculiar substance, differing from the uterine liquid (liquor amnii), and generally of a nutritious (?) nature. 2. That in physical and chemical properties, this substance varies very much in different animals, being in no two species precisely similar. 3. That in each fœtal animal the contents of the stomach vary much at different periods; in the earlier stages of its development consisting chiefly of liquor amnii, to which the other peculiar matters are gradually added. 4. That the liquor amnii continues to be swallowed by the fœtus up to the time of birth; and consequently after the formation of those matters, and their appearance in the stomach. 5. That the mixture of this more solid and nutritious substance with the liquor amnii constitutes the material submitted to the process of chymification in the fœtal intestines. He considers the contents of the alimentary canal to be chiefly derived from the salivary secretion. It is his opinion that there is no gastric juice secreted until respiration is established. The medical jurist will perceive, therefore, that the discovery of farinaceous food, milk, or sugar in the stomach, will furnish evidence of birth; since substances of this kind are not found in the fœtal stomach. The substances which naturally exist in the stomach of the fœtus, are of an albuminous and mucous nature.

Evidence from the mode of birth.—It has been suggested that when a child is born by the feet and there are full marks of respiration in the lungs, the mode of birth will at once establish that the body of the child must have been entirely in the world in order that the breathing should have taken place. Dr. W. B. Herapath met with an instance of this kind in September 1858, and communicated the particulars to me. It is assumed that the head under these circumstances is born instantaneously, and that the child cannot breathe until the head is released from the outlet. Before such a conclusion can be drawn there must be clear evidence that the child was actually born by the feet.

Dr. Herapath has published a report of the case on which his opinion was requested, as well as the grounds on which he would rely to establish the fact that a child had been born by the feet. (British Med. Jour. May 15, 1859.)

Defective evidence.—The slightest consideration will show that the signs of live birth above described are weak, and of purely accidental occurrence. If a child is destroyed during birth or within a few minutes afterwards, there will be no medical evidence to indicate the period at which its destruction took place. The external and internal appearances presented by the body, would be the same in the two cases. It is most probable that in the greater number of instances of child-murder, the child is actually destroyed either during birth, or immediately afterwards; and, therefore, the characters above described can rarely be available in practice. If any exception be made, it is with respect to the nature, situation, and extent of marks of violence; but the presence of these depends on mere accident. Hence, then, we come to the conclusion, that although medical evidence can often show, from the state of the lungs, that a child has really lived, it can rarely be in a condition to prove in a case of infanticide, that its life certainly continued after its birth. We could only venture upon this inference when the signs of respiration were full and complete, or when food was found in the stomach. Why the destruction of a child should be treated in the one case as a venial offence, and in the other as a capital crime, is one of those anomalies in our criminal jurisprudence for which it is impossible to account. The inference which we may draw from these observations is, that if positive proof of *entire live birth* be in all cases rigorously demanded of medical witnesses on trials for child-murder, it is scarcely possible, when the prisoner is ably defended, that any conviction for the crime should take place. The only exception would be, where a confession was made by the accused, or the murder was actually perpetrated before eye-witnesses. The numerous acquittals that take place on trials for this crime, in face of the strongest medical evidence, bear out the correctness of this opinion. The child is proved to have lived and breathed, but the medical evidence fails to show that the living and breathing took place or continued after *entire* delivery. [For some judicious remarks on this defective state of the law, see Prov. Journ. April 2, 1851, p. 182.]

Conclusions.—The general conclusions which may be drawn from the facts contained in this chapter, on the question whether a child has or has not been *born alive*, are as follows:—

1. That if the lungs be fully and perfectly distended with air by the act of respiration, this affords a strong presumption that the child has been *born alive*, since respiration during birth is in general only partial and imperfect.

2. That the presence of marks of severe violence on various parts of the body, if possessing vital characters, renders it probable that the child was entirely born alive when the violence was inflicted.

3. That certain changes in the umbilical vessels, and the separation by a vital process and cicatrization of the umbilical cord, as well as a general peeling or scaling off of the cuticle, indicate live birth.

4. That the absence of meconium from the intestines, and of urine from the bladder, are not proofs that a child has been entirely born alive, since these liquids may be discharged during the act of birth.

5. That the open or contracted state of the foramen ovale or ductus arteriosus, furnishes no evidence of a child having been born alive. These parts may become closed and contracted *before birth*, and therefore in a child born dead; or they may remain open after birth in a child born living, even after the establishment of respiration.

6. That the presence of farinaceous or other food in the stomach proves that a child has been entirely born alive.

7. That irrespective of the above conclusions, there is no certain medical sign which indicates that a child, that has died at or about the time of birth, has been *entirely* born alive.

CHAPTER 44.

RULES FOR DETERMINING THE PERIOD OF SURVIVORSHIP IN CHILDREN THAT HAVE BEEN BORN ALIVE. APPEARANCES INDICATIVE OF A CHILD HAVING LIVED TWENTY-FOUR HOURS — FROM TWO TO THREE DAYS — FROM THREE TO FOUR DAYS — FROM FOUR TO SIX DAYS — FROM SIX TO TWELVE DAYS. UNCERTAINTY OF MEDICAL EVIDENCE ON THE PERIOD WHICH HAS ELAPSED SINCE THE DEATH OF A CHILD. PROCESS OF PUTREFACTION IN THE BODIES OF NEW-BORN CHILDREN. GENERAL CONCLUSIONS.

If we suppose it has been clearly established, that a child not only lived but was actually *born* alive, it may be a question whether it lived for a certain number of hours or days after it was born. The answer to this question may be necessary in order to connect the deceased child with the supposed mother. It has been remarked that scarcely any appreciable changes take place in the body of a living child, until after the lapse of twenty-four hours; and these changes may be considerably affected by its degree of maturity, healthiness, and vigour. The following may be taken as a summary of the appearances in a child that has survived its birth for different periods:—

1. *After twenty-four hours.*—The skin is firm and pale, or less red than soon after birth. The umbilical cord is somewhat shrivelled, although it remains soft and bluish-coloured. from the point where it is secured by a ligature, to its insertion in the skin of the abdomen. The meconium is discharged; but a green-coloured mucus is found on the surface of the large intestines. The lungs may be more or less distended with air. although in a case of survivorship for a period longer than this. no trace of air was found in them. With regard to the state of the lungs, it should be remembered that when these organs are fully and perfectly distended, the inference is that the child has probably survived many hours; but the converse of this proposition is not always true. Several cases already reported show that when the lungs contain a small quantity of air, it does not follow that the child must have died immediately after it was born.

2. *From the second to the third day.*—The skin has a yellowish tinge, the cuticle sometimes appears cracked, a change which precedes its separation in scales. (Devergie, vol. 1. p. 519.) The umbilical cord is brown and dry between the ligature and the abdomen.

3. *From the third to the fourth day.* The skin is more yellow and there is an evident separation of the cuticle from the skin of the chest and abdomen. The umbilical cord is of a brownish-red colour, flattened, semi-transparent, and twisted. The skin in contact with the dried portion presents a ring of vascularity or redness;—but Dr. Geoghegan met with this appearance in two cases of still-born children, and I have also seen it in four cases in which the children were born dead. (G. H. Rep. April 1842.) The colou is free from any traces of green mucosity.

1. *From the fourth to the sixth day.*—The cuticle in various parts of the body is found separating in the form of minute scales or of a fine powder. The umbilical cord separates from the abdomen usually about the *fifth day*, but sometimes not until the eighth or the tenth. The membranous coverings become first detached, then the arteries, and afterwards the vein. If the umbilical aperture is cicatrized and *healed*, it is probable that the child has lived from three weeks to a month after birth. The ductus arteriosus may be found contracted both in length and diameter: the foramen ovale may be also partly closed.

5. *From the sixth to the twelfth day.*—The cuticle will be found separating from the skin of the limbs. If the umbilical cord was small, cicatrization will have taken place before the tenth day after birth. If large, a sero-purulent discharge will

sometimes continue for twenty-five or thirty days. The ductus arteriosus is said to become entirely closed during this period; but this statement is open to exceptions which have been elsewhere pointed out (*ante*, p. 468). It need hardly be observed that the body rapidly increases in weight when the child has enjoyed active existence.

On the whole, it will be seen that the signs of survivorship for short periods after birth are not very distinct. There is commonly no difficulty in determining the fact after the second day. The changes stated to take place in the umbilical cord during the first twenty four hours, may be observed in the *dead* as well as in the living child; and the other changes occur with much uncertainty as to the period. These are, however, I believe the principal facts upon which a medical opinion on such a subject can be based; and it is in some respects fortunate, that great precision in assigning the time of survivorship is not demanded of medical witnesses.

Putrefaction in the new-born child.—A practitioner may be further required to state *how long a period has elapsed since the death of the child.* The answer to the previous question was derived from the changes which take place in the body of a child during *life*, while, in relation to the present inquiry, we must look to those which occur in the body after *death:* in other words, to the different stages of putrefaction. From the observations of Orfila, it would appear that the body of an infant putrefies more rapidly than that of an adult. (Traité des Exhumations.) In forming a judgment on this point, due allowance must be made for the influence of temperature, humidity, and the free access of air. If the body has been sunk in water, putrefaction takes place more slowly than usual, and the process is slower in running than in stagnant water. When the body is floating on the surface of water, so as to be at the same time exposed to air, then putrefaction takes place very rapidly: — and this also happens when the body, after removal from water, has been exposed to the air for some time. Putrefaction is retarded when the deceased child has been buried in the ground in a box or coffin, unless the process had commenced prior to interment. When the body has been cut up and mangled before being thus disposed of, putrefaction takes place with much geater rapidity. (The *Queen* v. *Railton*, Stafford Winter Assizes, 1844.)

Conclusions.—The general conclusions respecting survivorship are: —

1. That the period for which a new-born child has survived birth, cannot be determined by any certain sign for the first twenty-four hours.

2. That after this period, an inference may be drawn from certain changes which take place progressively in the skin and

umbilical cord externally, and in the viscera on inspection; — that these changes allow only of an approximate opinion within the first five or six days.

3. That the contraction of the foramen ovale and ductus arteriosus takes place from natural changes at such uncertain intervals, as to render it difficult to assign a period of survivorship from the state of these parts.

4. That the period which has elapsed since the child died, after it was born, can only be determined by observing the degree of putrefaction in the body compared with temperature, locality, and other conditions to which it has been exposed.

CHAPTER 45.

CAUSES OF DEATH IN NEW-BORN CHILDREN—PROPORTION OF CHILDREN BORN DEAD—NATURAL CAUSES OF DEATH—A PROTRACTED DELIVERY—DEBILITY—HÆMORRHAGE—LACERATION OF THE CORD—COMPRESSION OF THE CORD—MALFORMATION—DESTRUCTION OF MONSTROUS BIRTHS ILLEGAL—DEATH FROM CONGENITAL DISEASE. GENERAL CONCLUSIONS.

Causes of death in new-born children.—The next important question in a case of infanticide, and that upon which a charge of murder essentially rests, is,—what was the cause of death? 1. It is admitted that a child may die during birth or afterwards. 2. In either of these cases it may die from *natural* or *violent causes.* The violent causes may have originated in *accident* or in *criminal design.* The last case only involves the corpus delicti of child-murder. If death has clearly proceeded from natural causes, it is of no importance to settle whether the cause operated during or after birth: — all charge of criminality is thenceforth at an end.

Proportion of children born dead. — It is well-known that of children born under usual circumstances, a great number die from natural causes either during birth or soon afterwards: and in every case of infanticide, death will be presumed to have arisen from some cause of this kind, until the contrary appears from the evidence. This throws the onus of proof entirely on the prosecution. Many children die before performing the act of respiration; and thus a large number come into the world still-born or dead. The proportion of *still-born* among legitimate children, as it is derived from statistical tables extending over a series of years, and embracing not less than eight millions of births, varies from one in eighteen to one in twenty of all births. (B. and F. Med. Rev. No. 7. p. 235.) The late Dr. Lever found, that among three thousand births, one child in eighteen was born dead. In immature and illegitimate children, the proportionate mortality is much greater,—probably about one in eight or ten. In Göttingen the deaths were found to amount to one in seven, and in Berlin, to one in ten. (Ed. Med. and Sur. Jour. vol. 36, p. 172.) Males are more frequently born dead than females, in the ratio of 140 : 100,—while the males to females born, has only a ratio of 106 : 100. (Dr. Simpson, Ed. Med. and Sur. Jour. Oct. 1844, p. 395.) The preponderance of still-births among males is ascribed to the large size of the head, and the injury thus likely to be inflicted on the brain during delivery. Still-births are much more frequent in first than in after pregnancies. These facts should be borne in mind, when we are estimating the probability of the cause of death being natural. Should respiration be established by the protrusion of the child's head from the outlet, or the birth of its body, the chances of death from natural causes are considerably diminished. Nevertheless, as Dr. Hunter long ago suggested, a child may breathe and die. Thus, according to this author,—" If the child makes but one gasp and instantly dies, the lungs will swim in water, as readily as if it had breathed longer and had then been strangled." In general, it would require more than one gasp to cause the lungs to swim readily in water; but waving this point, the real question is,—if the child breathed after birth, what could have caused its death ? The number of gasps which a child may make, or which may be required for the lungs to swim in water, is of no moment : — the point to be considered is, whether its death was due to causes of an accidental or criminal nature. So again observes Dr. Hunter : " We frequently see children born, who from circumstances in their constitution or in the nature of the labour, are but barely alive, and after breathing a minute or two or an hour or two, die in spite of all our attention. And why may not this misfortune happen to a woman who is brought to bed by herself? " (Op. cit.) The substance of this remark is, that many children may die naturally after birth; and in Dr. Hunter's time, these cases were not perhaps sufficiently attended to. In the present day, however, the case is different: — a charge of child-murder is seldom raised, except in those instances where there are the most obvious marks of severe and mortal injuries on the body of a child; and unless it be intended to defend and justify the practice of infanticide, it must be admitted that the discovery of violence of this kind on the body of a new-born infant, renders a full inquiry into the circumstances necessary. Among the *natural causes* of the death of a child may be enumerated the following : —

1. *A protracted delivery.*—The death of a child may proceed, in this case, from injury suffered by the head during the violent

contractions of the uterus, or from an interruption to the circulation in the umbilical cord before respiration is established. A child, especially if feeble and delicate, may die from exhaustion under these circumstances. This cause of death may be suspected when a sero-sanguinolent tumour (called *cephalæmatoma*, or *caput succedaneum*) is found on the head of a child, and the head itself is deformed or elongated:—internally by the congested state of the cerebral vessels. The existence of deformity in the pelvis of the woman might corroborate this view; but in primiparous females (among whom charges of child-murder chiefly lie) with well-formed pelves, delivery is frequently protracted. It is presumed that there are no marks of violence on the body of the child, excepting those which may have arisen accidentally in attempts at self-delivery.

2. *Debility.*—A child may be born prematurely, or at the full period, and not survive its birth, owing to a natural feebleness of system. This is especially observed with immature children; and it is the condition more especially dwelt on by Dr. Hunter. Such children may continue in existence for several hours, feebly respiring, and then die from mere weakness. These cases may be recognized by the appearance of a general want of development in the body.

3. *Hæmorrhage. Laceration of the cord.*—A child may die from loss of blood, owing to a premature separation of the placenta or an accidental rupture of the umbilical cord. In the latter case it is said the loss of blood is not likely to prove fatal if respiration has been established; but an instance is reported in which a child died from hæmorrhage even under these circumstances. (Henke's Zeitschrift, 1839, Erg. H. p. 200; also, 1840, vol. 1. p. 347, and vol. 2. p. 105. Ann. d'Hyg. 1831, vol. ii. p. 128.) Bleeding from the cord has in some cases taken place at various periods after birth, and has led to the death of the child. (Ed. Month. Jour. July 1847, p. 70.) Death from hæmorrhage may be commonly recognized by the blanched appearance of the body and a want of blood in the internal organs; but there are several cases on record in which the cord was ruptured close to the abdomen without causing the death of the child. It was formerly a debated question whether, in the event of the umbilical cord being left untied after cutting or laceration, such a degree of hæmorrhage could in any instance occur as would prove fatal to a child. The case just now referred to renders it unnecessary to discuss this question. Bleeding is more likely to prove fatal when the cord is divided by a sharp instrument, than when it is lacerated; and its dangerous effects on a child are likely to be great in proportion as the division is made near to the navel. It has been improperly described as a case of infanticide by *omission*, when a self-delivered woman neglects to apply a ligature to the cord under these circumstances; because, it is said, she

ought to know the necessity for this in order to prevent the child dying from hæmorrhage. Such a view assumes not only malice against the accused, but that in the midst of her distress and pain she must necessarily possess the knowledge and bodily capacity of an accoucheur,—a doctrine wholly repugnant to the common feelings of humanity. This question was, however, actually raised in the case of the *Queen* v. *Dash*, August 1842. There was no doubt in this instance that the child had breathed, and that its death had been caused by bleeding from the lacerated umbilical cord. The medical witness properly admitted that the cord might have been torn through by the mere weight of the child during labour; and the jury acquitted the prisoner, on the ground that she might have been ignorant of the necessity, or not have had the power, to tie the cord. The cord, especially when short, may become accidentally ruptured during delivery. A case of this kind occurred to Mr. Mackie. (Med. Times, July 24, 1847, p. 433.) The child was born alive after a strong pain; and on examination it was found that the cord was torn through at about an inch from the abdomen.

Bleeding from the vessels of the cord may prove fatal several days after birth, even when a child has been properly attended to, and the navel-string has separated by the natural process. Mr. Willing has reported a case of this kind, in which, in spite of every application, the child died from loss of blood six days after the separation of the cord. (Med. Times and Gaz. March 25, 1854, p. 287.) The impossibility of arresting the bleeding in this case appeared to depend upon a great deficiency of fibrin in the blood, and a consequent want of tendency to coagulation.

4. *Compression of the cord.*—When a child is born by the feet or buttocks, the cord may be so compressed under strong uterine contraction that the circulation between the mother and child will be arrested, and the latter will die. The same fatal compression may follow when, during delivery, the cord becomes twisted round the neck. A child has been known to die under these circumstances before parturition, the cord having become twisted round its neck in utero. (Med. Gaz. Oct. 1840, p. 122.) Other cases from this cause, during delivery, will be found in the same journal. (Vol. 19. pp. 232, 233.) On these occasions, the child is sometimes described to have died from strangulation; but it is evident that before the establishment of respiration such a form of expression is improper. There are few or no appearances indicative of the cause of death. There may be lividity about the head and face, and cerebral congestion internally: it is, however, proper to state, that the brain of a child is always more congested than that of an adult.

5. *Malformation.*—There may be a deficiency of some vital organ, which would at once account for a child dying either

during delivery or soon after its birth. Two cases are reported, in one of which the child died from an absolute deficiency of the gullet, — the pharynx terminating in a cul-de-sac: in the other, the duodenum was obliterated for more than an inch, and this had occasioned the child's death. (Med. Gaz. vol. 26, p. 542.) In a third, recorded by Mr. Fairbairn, a child was suffocated by retraction of the base of the tongue, owing to defect of the frænum. (North. Jour. Med. March 1849, p. 278.) The varieties of malformation are very numerous, but there can be no difficulty in determining whether they are such as to account for death. Individuals are not allowed to destroy these monstrous births: and the presence of all marks of violence in such cases should be regarded with suspicion. It is the more necessary to make this statement, as there is an idea among the vulgar that it is not illegal to destroy a monstrous birth. Mr. Pooley, of Cirencester, communicated to me a case which occurred some years since in his practice: — A lady was delivered of a most hideous dicephalous monster. In his absence, and at the earnest solicitations of the friends, the nurse destroyed it. The question was — Was this woman guilty of child-murder? The only case in reference to this point which is recorded by medico-legal writers, is that of two women who were tried at the York Assizes in 1812, for drowning a child which was born with some malformation of the head, in consequence of which it was likely that it could not survive many hours. There did not appear to have been any concealment on the part of the prisoners, who were not aware of the illegality of the act. (Paris and Fonblanque, Med. Jur. vol. 1, p. 228.) The absence of malicious intention would probably lead to an acquittal on a charge of murder: but such an act would doubtless amount to manslaughter. The degree of monstrosity or the viability of the offspring cannot be received as extenuating circumstances: as to the first, if a liberty of judging what was monstrous and what not, were conceded to any ignorant nurse, children simply deformed might be put to death on this pretence; — as to the second, it is held in law that whoever accelerates death causes it. — hence the fact that the offspring is not likely to live more than a few hours, does not justify the act of one who prematurely destroys it.

6. *Congenital disease.* — It has been elsewhere stated, that a child may be born labouring under such a degree of congenital disease as to render it incapable of living. The discovery of any of the fœtal organs merely in a morbid condition, amounts to nothing, unless the disease has advanced to a degree which would be sufficient to account for death. There are, doubtless, many obscure affections, particularly of the brain, which are liable to destroy the life of a child without leaving any well-marked changes in the body. According to Dr. Burgess, apoplexy and asphyxia are common causes of death among new-born

children. (Med. Gaz. vol. 26, p. 492; Henke's Zeitschrift der S. A. 1843, p. 67.) Probably diseases of the lungs are of the greatest importance in a medico-legal view; because, by directly affecting the organs of respiration, they render it impossible for a child to live, or to survive its birth for a long period. These diseases in the fœtal state are principally congestion, hepatization, tubercle, scirrhus, and œdema,— the existence of any of which it is not difficult to discover. They render the structure of the lungs heavier than water; and thus prevent the organs from acquiring that buoyancy which in their healthier state they are known to possess. It is not common to find the lungs diseased throughout: — a portion may be sufficiently healthy to allow of a partial performance of respiration. The lungs may not be found diseased, but simply in that state which has been elsewhere described under the name of atelectasis (*ante*, p. 438). The causes upon which this condition of the lungs depends are not well understood. The non-establishment of respiration sometimes arises from the mouth and fauces of the child being filled with mucus. An enlargement of the thyroid gland has occasionally led to the death of a new-born child by suffocation. (Ed. Month. Jour. July 1847, p. 64.)

Conclusions.— The following conclusions may be drawn from the preceding remarks: —

1. That a large number of illegitimate children, especially when immature, are born dead from *natural* causes.

2. That a child may die from exhaustion, as the result of a protracted labour.

3. That if a child be prematurely born, or if it be small and weak even at the natural period, it may die from mere debility or want of power in the constitution either to commence or to continue the act of respiration.

4. A child may die from loss of blood, owing to accidental rupture of the cord during delivery. It may even die from this cause after it has breathed.

5. That fatal bleeding is more likely to occur when the cord has been cut close to the abdomen, than when it has been lacerated or cut at a distance from the navel.

6. That the division of the cord, whether by rupture or incision, without ligature, is by no means necessarily fatal to a healthy mature child.

7. That a child may die from accidental compression of the cord during delivery,—the circulation between the mother and child being thereby arrested before respiration has commenced.

8. That death may speedily follow birth, from some malformation or defect of important organs.

9. That a child may die from congenital disease affecting the organs of respiration or the air-passages.

CHAPTER 46.

VIOLENT CAUSES OF DEATH. — FORMS OF VIOLENT DEATH UNATTENDED BY MARKS OF EXTERNAL VIOLENCE — SUFFOCATION — DROWNING — IN THE SOIL OF PRIVIES — POWER OF LOCOMOTION AND EXERTION IN FEMALES AFTER DELIVERY. —DEATH OF THE CHILD FROM COLD AND EXPOSURE—STARVATION — IMMATURITY IN CASES OF ABORTION. — WOUNDS, EVIDENCE FROM, IN NEW-BORN CHILDREN — FRACTURES OF THE SKULL, SPONTANEOUS AND CRIMINAL—DEATH OF THE CHILD FROM DELIVERY IN THE ERECT POSTURE—ACCIDENTAL INJURIES IN UTERO—DEFICIENT OSSIFICATION—TWISTING OF THE NECK.—VIOLENCE IN SELF-DELIVERY.—GENERAL CONCLUSIONS.

Violent causes of death.—In this chapter we shall have to consider those modes of death which are totally independent of the existence of congenital disease or other natural causes. It is proper for the medical jurist to remember that there are certain forms of child-murder which are not necessarily attended with any appearance indicative of violence, —these are, suffocation, drowning, exposure to cold, and starvation.

1. *Suffocation.* — This is a very common cause of death in new-born children. A wet cloth may be placed over the child's mouth, or thrust into that cavity during birth or afterwards, and before or after the performance of respiration. To the latter case only, could the term suffocation be strictly applied. A child may be thus destroyed by being allowed to remain closely compressed under the bed-clothes after delivery, or by its head being thrust into straw, feathers, and such-like substances. The appearances in the body are seldom sufficient to excite a suspicion of the cause of death, unless undue violence has been employed. There is commonly merely lividity about the head and face, with slight congestion in the lungs. A careful examination of the mouth and throat should be made, as foreign substances are sometimes found in this situation, affording circumstantial evidence of the mode in which the suffocation has taken place. Thus wood, straw, feathers, dust, tow, or a hard plug of linen, may be, and in some cases have been, found blocking up the mouth and fauces (*ante*, p. 469, *post*, SUFFOCATION). Again, a child may be suffocated by having its head held over noxious vapours, as the exhalations of a privy or of burning sulphur; and it is here necessary to remind the medical jurist that other highly poisonous vapours may be used by a criminal without leaving any trace upon the body, except, possibly, that which may depend upon their peculiar odour. There are few of these cases of suffocation in which a

medical opinion of the cause of death could be given, unless some circumstantial evidence were produced, and the witness were allowed to say whether the alleged facts were sufficient to account for death. (Annales d'Hyg. 1832, t. 1. p. 621.)

On the other hand, if it be even clearly proved that death has been caused by suffocation, it must be remembered that a child may be accidentally suffocated, and the crime of murder falsely imputed. Dr. Hunter, who was well aware of the risk to which a female might be thus exposed, observes in relation to this point,—"When a woman is delivered by herself, a strong child may be born perfectly alive, and die in a very few minutes for want of breath, either by being on its face in a pool formed by the natural discharges, or upon wet clothes; — or by the wet things over it collapsing and excluding air, or drawn close to its mouth and nose by the suction of breathing. An unhappy woman delivered by herself, distracted in her mind and exhausted in her body, will not have strength or recollection enough to fly instantly to the relief of her child." (Op. cit. 35.) It may be added that a primiparous female may faint or become wholly unconscious of her situation; or if conscious, she may be ignorant of the necessity of removing the child, and thus it may be suffocated without her having been intentionally accessory to its death. In such cases, however, there should be no marks of violence on the body, or if present, they should be of such a nature and in such a situation as to be readily explicable on the supposition of an accidental origin. An infant is very easily destroyed by suffocation. If the mouth and nostrils are kept covered for a few minutes, by the face being closely wrapped in clothes, asphyxia may come on without this being indicated by convulsions or any other marked symptoms. A suspicion of murder may arise in such cases; but the absence of marks of violence, with an explanation of the circumstances, will rarely allow the case to be carried beyond an inquest. Sometimes the body is found maltreated, with severe fractures or contusions on the skull, with marks of strangulation on the neck,—concealed in a feather-bed or privy: — or cut up and burnt. This kind of violence may properly excite a suspicion of murder, and lead to the belief that the allegation of death from accidental suffocation is a mere pretence. This, however, is purely a question for a jury, and not for a medical witness. Unless the case be of a very glaring nature, the violence is considered to have been employed for the purpose rather of concealing the birth of a child than of destroying it. In the present day, these cases of death from accidental suffocation, when properly investigated, can never involve an innocent woman in a charge of murder, although the facts may show in many instances that the death of the child was really due to great imprudence, neglect, or indifference on her part.

The following case (the *Queen* v. *Mortiboys*), tried in 1841, will show that even when the evidence is strong against a person, the circumstances will be favourably interpreted. In this instance it was proved that the body of the child was discovered in a box containing wool: it was lying on its abdomen, with its face raised and its mouth open. A red worsted comforter had been passed twice round the neck, and was tied a second time in a single knot over the chin. In the mouth, which was open, was found a small quantity of fine flocks of wool. The medical evidence showed that the child had been born alive, the left lung being fully inflated. The brain was congested. There was no mark produced by the ligature on the neck, either externally or internally. Death was referred to obstructed respiration (suffocation), caused partly by the ligature and partly by the wool in the mouth,—but the latter was considered to be the more active cause. In the defence it was urged that the ligature could not have produced strangulation, because the comforter was tied upon the chin,—that the medical evidence showed the wool in the mouth to have been the immediate cause of death,—this was probably taken into the mouth by the child itself in the instinctive action of breathing, and not put there by the prisoner for the purpose of suffocation. The child had probably been placed carelessly on a quantity of wool, into which it had sunk by its own weight, and this had caused its death. It is reported that the judge joined in this view, and in charging the jury, said, that had the prisoner intended to choke the child with the wool, she would have inserted enough to fill its mouth. The prisoner was acquitted. In this case, admitting that the evidence did not bear out the charge of murder, still it is pretty clear that death was caused by the child being placed on its face, with a ligature round the neck, in a close box filled with wool. Admitting the facts to have been as represented, there appears to have been in this case something more than an accident: for the prisoner must have known that a new-born infant was not likely to live long under such circumstances, and had the child been a week or a month old she would probably have been convicted of manslaughter or murder. A case of alleged infanticide, by suffocation, has been reported by Dr. Easton. (Cormack's Journal, Feb. 1845.) There is no doubt that the child in this case was suffocated by a quantity of mud being forced into its mouth and throat. Its presence in the gullet was incompatible with its having entered by gravitation. In the case of *Macintyre* (Glasgow Ant. Circ. 1829), several small pieces of straw were found in the stomach of a child, of the same kind as those which were in the bed where the birth took place. In another case reported by Dr. Littlejohn, it was found that a mass of dough, or bread-pulp, had been forcibly impacted in the throat and larynx of the child. It was found to be accurately moulded to the parts. (Ed. Med. Jour. December 1855, p. 521.)

2. *Drowning.*—The fact of drowning cannot be verified by any appearances on the body of a child which has *not* breathed. Thus, if a woman caused herself to be delivered in a bath, and the child was forcibly retained under water (a case which is said to have occurred), it would of course die; but no evidence of the mode of death would be found in the body. [For a case in which a child was thus destroyed, probably however through accidental circumstances, see Cormack's Ed. Journal, Oct. 1845 p. 796.] After respiration, the signs of drowning will be the same as those met with in the adult. (See *post*, DROWNING.) The main question for a witness to decide, will be whether the child was put into the water living or dead. Infanticide by drowning is by no means common:—the child is generally suffocated, strangled, or destroyed in other ways, and its body is then thrown into water, in order to conceal the real manner of its death. The fact of the dead body of an infant being found in water, must not allow a witness to be thrown off his guard, although a verdict of "found drowned" is so commonly returned in these cases. The body should be carefully inspected, in order to determine what was really the cause of death. All marks of violence on the bodies of children that have died by drowning, should be such as to have resulted from accidental causes. It is not necessary that the *whole* of the body should be submerged, in order that a child should be destroyed by drowning: the mere immersion of the head in water will suffice to produce all the usual effects. The air passages should therefore be examined for foreign substances. A case occurred in London in 1842, in which a woman attempted to destroy her child by immersing its head only in a bucket of water. The child was discovered, and resuscitated.

New-born children may be drowned or suffocated by being thrown into mud, or into the soil of a privy. Sometimes the child is destroyed by other means, and its body is thus disposed of for the purposes of concealment. Should there be a large quantity of liquid present, the phenomena are those of drowning. This liquid abounding in hydrosulphuret of ammonia may then be found, if the child was thrown in living, in the air-passages, gullet, or stomach. The mere discovery of soil in the mouth would not suffice to show that the child was living when immersed. The presence of foreign substances, such as dirt, straw, or ashes in the air-passages, gullet, and stomach, has usually been taken as a medical proof of the child having been living when immersed in the dirt, &c., and that the substances had been drawn into the passages by inspiration or the act of swallowing. Here, however, there is a wide field for conflicting medical opinions. In *Reg.* v. *Allridge* (Derby Winter Assizes, 1859), the dead body of a child was found buried in a garden. On examination, there was earth in the mouth and throat, and in both nostrils at the back part; and particles of earth were found in the wind-pipe and bronchi, as well as in the stomach. The medical witness referred the death to suffocation, and considered that the earth must have been inhaled. Another medical witness, called for the defence, affirmed that the earth might have been carried into the passages of the body accidentally by the percolation of water (in eight days), and that it had not found its way there by inhalation. The jury upon this acquitted the prisoner. Although the mouth and throat may thus receive accidentally foreign matters, it is improbable that earth should be carried into the bronchi or stomach. The child was probably thrust into the earth with some power of breathing and swallowing, and the earth found in the mouth and throat might be assigned to the violence with which it was forced into the soil. The nature of the soil, and the circumstances under which the dead body is found, must materially guide a medical opinion in cases of this nature. This subject has been fully examined by Dr. Märklin (Casper's Vierletjahrsch, 1859, vol. 2. p. 32.), and by Dr. Simeons, in the same journal, 1860, vol. 2. p. 287.

On these occasions, the defence may be — 1. that the child was born dead, and that the body was thrown in for concealment; but the medical evidence may show that the child had breathed and had probably been born living. 2. It may be alleged that the child breathed for a few moments after birth, but then died, and that the female thus attempted to conceal the body. A medical witness may be here asked, whether a woman could have had power to convey the body to the place, — a point which must, as a general rule, be conceded. 3. It is most commonly urged, that the woman being compelled to go to the privy, was there *delivered unconsciously*, and that the child dropped from her, and was either suffocated or prevented from breathing. All these circumstances may readily occur, but on the other hand the explanation may be inconsistent with medical facts. Thus the head or the limbs of a child may be found to have been separated or divided by some cutting instrument, — or a cord or other ligature may be found tightly bound around its neck, or there may be a tightly fitting plug in the throat. Then, again, the body may be entire, but the umbilical cord may be *cleanly cut*. This would tend to set aside the explanation of the child having accidentally dropped from the female: because in such an accident the cord should be found *ruptured*. The practitioner should make a careful examination of the divided ends of the cord by the aid of a lens, or a rupture may be mistaken for a section with a sharp instrument. Mr. Higginson, of Liverpool, has lately published a case of some interest in this point of view. The child fell from the mother, and the cord broke spontaneously. "The torn ends were nearly as sharp-edged and flat as if cut." (Med. Gaz. vol. 48. p. 985.) This case goes to prove that a careless or hasty examination of the ends of the cord may lead to a serious mistake. Sometimes the mark of a previous cut may be found on the cord near one of its divided ends,—the first cut with scissors not having effectually divided it. In a case tried at Lewes Lent Assizes, 1852, Mr. Gardner proved, in reference to the body of a child which had been found in a privy, that the cord had been ineffectually cut in one spot previous to its complete division. The cord had also been pulled out after this cut, so as to elongate the vessels; hence they projected from one part of the sheath at one cut portion, while they were retracted in the other. This accurate observation showed not only that the cord had not been ruptured by the child accidentally falling from the mother, but it served to establish the identity of the placenta, which was found concealed at a distance from the body. When the cord is lacerated, this will be, *cæteris paribus*, in favour of the woman's statement as to the mode in which her delivery occurred. (For a case involving this question, see Med. Gaz. vol. 10, p. 374.) In a case which occurred to Dr. Wharrie, in which the child fell from a female while sitting over a large jug containing water, and in which it was evident there had been no respiration, the cord was found tied. The child was removed from the vessel dead; therefore the ligature must have been applied after death. Drowning may be the result of accident from sudden delivery. A woman in an advanced state of pregnancy while sitting on a chamber vessel was suddenly delivered. The child fell into the fluids in the vessel, and before assistance could be rendered it was dead. (See a case in Casper's Vierteljahrsch, 1859, vol. 2, p. 36.)

Circumstantial evidence.—Whether, in any instance, the *drowning* of a child was accidental or criminal, must be a question for a jury to determine from all the facts laid before them. The situation in which the body of an infant is found, may plainly contradict the supposition of accident. On the other hand, a child may be accidentallly drowned by its mouth falling into a pool of the discharges during delivery, although this would be rather a case of suffocation. The stomach of the child should always be examined on these occasions, as mud, sticks, straws, weeds, or other substances, may be found, indicating, according to circumstances, that the child had been put into the water living, and that it had been drowned in a particular pond or vessel.

Sudden delivery. The pains of labour mistaken for other sensations.—In cases like that reported by Dr. Wharrie, where a female, under the impression that she was about to have a motion, sat over a large water-jug and was delivered of a child, it is proper to make full allowance for a mistake which may be compatible with innocence. A woman is often unable to distinguish the sense of fulness, produced by the descent of a child, from the feeling which leads her to suppose that she is about to have an evacuation: and thus it is dangerous, when a labour has advanced, to allow a female to yield to this feeling; for there is nothing more probable than that the child will be suddenly born. Mr. Rankin, of Carluke, has reported two cases of this description, where there could not be the slightest suspicion of criminality. In one, a primipara, the child was actually born under these circumstances; but its life was fortunately saved.—had there been no other convenience than a privy, it must have been inevitably lost. In the second, although a case of third pregnancy, the female was equally deceived by her sensations. (Ed. Month. Jour. Jan. 1846, p. 11; see also a case in which twins were thus born, Med. Times and Gaz., March 2, 1861, p. 235.) It is true that this alleged mistaken sensation forms a frequent and specious defence on charges of child-murder; but still a medical jurist is bound to admit that an accident which occurs to females of the middle class, may also occur to the poor without necessarily implying guilt. (For a case of rapid delivery in a primipara, see Med. Times and Gazette, Feb. 6, 1858.)

Power of exertion in recently-delivered females.—On these occasions, a witness will often find himself questioned respecting the strength or capability for exertion evinced by the lower class of women, shortly after child-birth. Alison remarks, that many respectable medical practitioners, judging only from what they have observed among the higher ranks, are liable to be led into an erroneous opinion, which may be injurious to an accused party. He mentions a case, in which a woman charged with child-murder walked a distance of twenty-eight miles in a single day, with her child on her back, two or three days after her delivery. (Case of *Anderson*, Aberdeen Spring Circ. 1829.) Instances have even occurred in which women have walked six and eight miles on the very day of their delivery, without sensible inconvenience. (Criminal Law, 161.) In one case (*Smith*, Ayr. Spr. Circ. 1824), the woman was engaged in reaping,—retired to a little distance, effected her delivery by herself, and went on with her work for the remainder of the day, appearing only a little paler and thinner! In the case of *Macdougal* (Aberdeen Spring Circ. 1823), the prisoner, who was sleeping in bed with two servants, rose, was delivered, and returned to bed without either of them being conscious of what had occurred. Cases like the last have often presented themselves in the English Courts.

3. *Cold.*—A new-born child may be easily destroyed by simply exposing it uncovered, or but slightly covered, in a cold atmosphere. In a case of this kind, there may be no marks of violence on the body, or these may be slight and evidently of accidental origin. In death from cold, the only appearance occasionally met with has been congestion of the brain with or without serous effusion in the ventricles. (See COLD.) The evidence, in these cases, must be purely circumstantial. The medical witness may have to consider, how far the situation in which the body was found,—the kind of exposure and the temperature of the air, would suffice to account for death from the alleged cause. There is no doubt that a new-born child is easily affected by a low temperature, and that warm clothing is required for the preservation of its life. An inspection of the body should never be omitted on these occasions; because it might turn out that there was some latent cause of natural death which would at once do away with the charge of murder. Admitting that the child died from cold, it becomes necessary to inquire whether the prisoner exposed it with the malicious intention that it should thus perish. Unless wilful malice be made out, the accused cannot be convicted of infanticide. In general, females do not expose their children for the purpose of destroying them, but for the purpose of abandoning them: hence it is rare to hear of convictions for child-murder, where cold was the cause of death, although some medical jurists have called this infanticide by *omission*, an offence which does not appear to be recognised by the English law. In the case of the *Queen* v. *Walters* (Oxford Autumn Assizes, 1841), it was proved that the prisoner, while travelling in a waggon, had suddenly left it, and that she was delivered of a child, which was afterwards found dead and exposed on the road. There was no doubt that the child had been born alive; for it was heard to cry after it was abandoned by its mother, who appeared to have carried it some distance after it was born. The child had died from exposure to cold. The woman was convicted of manslaughter, and sentenced to ten years' transportation. (For other medico-legal cases of death from cold, see Henke's Zeitschrift, 1836; also, 1840, vol. 1. p. 168, Erg. II.) In the case of *Reg.* v. *Waters* (Exchequer Chamber, Jan. 1849), the judges held on appeal that the count which charged the prisoner with causing the death of her child by throwing it on a dust-heap, and leaving it exposed, was good, and the conviction was affirmed.

4. *Starvation.*—A new-born child kept long without food will die, and no evidence of the fact may be derivable from an examination of the body. There may be no marks of violence externally, nor any pathological changes internally, to account for death. This is a rare form of committing murder, unless

as it may be accidentally combined with exposure to cold. In order to convict the mother, it is necessary to show that the child was wilfully kept without food, with the criminal design of destroying it. Mere neglect or imprudence will not make the case infanticide. The only appearance likely to be found on examination of the body, would be complete emptiness of the alimentary canal. Without corroborative circumstantial evidence, this would not suffice to establish the cause of death: a medical witness could only form a probable conjecture on the point. In a suspected case of this kind, the contents of the stomach should be tested for farinaceous and other kinds of food. (See STARVATION, *post.*)

5. *Immaturity in cases of abortion.*—From the case of *Reg.* v. *West* (Nottingham Lent Assizes, 1848), it would appear that if by the perpetration of abortion, or the criminal inducement of premature labour, a child be born at so early a period of uterine life, that it dies merely from *immaturity*, the party causing the abortion, or leading to the premature birth, may be tried on a charge of murder. A midwife was alleged to have perpetrated abortion on a female who was between the fifth and sixth month of pregnancy. The child was born, living, but died five hours after its birth. There was no violence offered to it; and its death appeared to be due entirely to its immaturity. The prisoner was acquitted, apparently on the ground that abortion might have arisen from other causes.

Among those cases of violent death which leave on the body of the child certain marks or appearances indicative of the cause, may be mentioned wounds, strangulation and poisoning.

6. *Wounds.*—Probably this is one of the most frequent causes of death in cases of infanticide. Wounds may, however, be found on the body of a child which has died from some other cause. The principal questions which a medical witness has to answer, are:—1. Whether the wounds were inflicted during or after birth, or, to adopt the legal view of the matter, before or after the child was *entirely* in the world in a living state: for according to the decisions of our judges, a child is not considered living in law, at least its destruction does not appear to be *murder*, until its body is entirely born. In most cases it will be utterly impossible for a medical witness to return any answer to a question put in this form. All that medical evidence can pretend to show, is whether a child was living or not when the wounds were produced: — for whether the *whole* of its body was or was not in the world at this time, they will possess precisely the same characters. In a few cases only, a conjectural opinion may be formed from the nature, extent, and situation of these injuries.—2. The witness will be required to state, whether the wounds were inflicted before or after death.—3. Whether they were sufficient to account for death.

—4. Whether they originated in accident or criminal design. The child may have been destroyed by *burning*, and evidence must then be sought for by an examination of the state of the skin. All these questions have been fully considered in treating the subject of Wounds; and they therefore do not require any further notice in this place.

A case of infanticide was tried at the Buckingham Summer Assizes, 1840 (the *Queen* v. *Wood*), in which the main question was, whether five severe wounds found on the head of a child were inflicted before or after death, and accidentally or criminally. The mother confessed that the child was born alive, and had cried, but that it had died in five minutes after its birth. Its body was buried and it was assumed that the wounds might have been accidentally inflicted after death by a spade, which had been used for the burial. The medical witness attributed death to the wounds, which, in his opinion, could not have been accidentally produced, but he very properly admitted, in cross-examination, that the wounds would have presented the same appearances had they been inflicted immediately after death, while the blood was in a fluid state. Answers to questions of this kind can of course be given only in those cases in which the body has been examined soon after the infliction of the wounds. It would be extremely hazardous to pronounce an opinion when the child has been long dead. In the case of the *Queen* v. *Taylor* (York Lent Assizes, 1843), the child had been dead about a year, and when its body was found in a garret, it was so much dried up, that the medical witnesses were unable, with certainty, to state the sex. The left arm had been removed from the body, and on the throat was a cut extending nearly from ear to ear, which was considered to have been made by some sharp instrument; and from the retraction of the edges of the wound, the witnesses thought that it must have been produced during life or immediately after death. The prisoner was acquitted. In this case there do not appear to have been any good medical reasons for the opinion expressed respecting the time at which the wound had been caused. Certainly, the retraction of the edges could furnish no evidence in a wound produced a year before, and in a body so dried up as to render the recognition of the sex difficult. This may have been a case of child-murder, but there was no medical proof of it: it was not even proved that the child had come into the world living. Incised wounds found on the bodies of children may be referred to the use of a knife or scissors by the prisoner, in attempting to sever the navel-string, and they may therefore be due to accident. This point should not be forgotten, for a wound even of a severe kind might be thus accidentally inflicted. In such cases we should always expect to find the navel-string *cut*, and not lacerated.

The end of it may, for the purpose of examination, be stretched out on a piece of white card. In the case of the *Queen* v. *Wales* (Central Criminal Court, Sept. 1839), it was proved that there was a wound on the right side of the neck of the child, not involving any important vessels, although it had caused death. The medical witness allowed that it might have been accidentally inflicted in the manner suggested, and the prisoner was acquitted. As this question may be unexpectedly put at a trial, a witness should prepare himself for it by a careful examination of the wound and of the navel-string. This will in general suffice to show whether an incised wound has been produced accidentally in the manner alleged, or by criminal design. Intra-uterine wounds have been in some cases met with. Dr. Priestley has described one which involved a part of the scalp. (Med. Times and Gaz. March 12, 1859.)

Slight marks of external violence should not be overlooked:—minute punctures or incisions externally may correspond to deep-seated injury of vital organs. The spinal marrow is said to have been wounded by needles or stilettoes introduced between the vertebræ, the skin having been drawn down before the wound was inflicted, in order to give it a valvular character, and to render it apparently superficial. The brain is also said to have been wounded by similar weapons, through the nose or the thinner parts of the skull (the fontanelles).

In some cases the body of a child is found cut to pieces, and the allegation in defence may be that the child was still-born, and the body thus treated merely for the purpose of concealment. Dr. Toulmouche has reported a case of this kind, which was the subject of a trial in France in 1852. As the woman had not destroyed the lungs, experiments on these organs gave satisfactory results of perfect respiration. The cavities of the heart and great vessels were empty: the body was generally drained of blood, and the skin throughout very pale. This led to the inference that the mutilations must have been inflicted while the child was living, and as all the parts were healthy, and no natural cause of death apparent, Dr. Toulmouche ascribed the death of the child to the wounds. The woman was convicted, and condemned to twenty years' confinement in the galleys. (Ann. d'Hyg. 1853, t. 2. p. 200.) In this country she would probably have escaped under a verdict of concealment of birth, and have been sentenced to a year's imprisonment.

Marks of violence on the head.—It has been elsewhere remarked (*ante*, p. 482) that in a protracted delivery there is on the head of the child a tumour containing either serum, blood, or a mixture of the two. Non-professional persons may, when a woman has been secretly delivered, ascribe a tumour of this kind to violence, whereas it may really have been produced by natural causes. The tumour is generally situated on one of the parietal bones, its situation depending on that part of the body which presents during delivery. After the discharge of the waters, the scalp is firmly compressed by the mouth of the uterus, and subsequently by the os externum. This pressure interferes with the circulation through the skin, and causes the compressed portion of scalp to swell. In the simplest form of this tumour serum only is found in the swollen part: occasionally this is mixed with blood, and there are small ecchymoses of the scalp, as well as of the pericranium and skull, but there is no injury to the bones, nor is there any laceration of the skin externally. In other cases blood is found effused in the tumour either under the scalp, the membrane covering the skull (pericranium), or within the skull itself. The term *Cephalæmatoma* or *Caput succedaneum* is applied to tumours which have this natural origin. The sanguineous variety is more likely to be confounded with the effects of violence than the serous tumour; but it is identified by the scalp being always uninjured, although this may present redness and lividity. Violence from blows or falls which would produce bloody effusion beneath the scalp, or within the skull, would in general be indicated by injury to the skin or by fracture of the bones. At the same time the following case, which occurred to Dr. West, shows that caution is required in forming an opinion.

In this case the child died twenty-three days after birth. The tumour (cephalæmatoma) was about the size of a walnut originally, but it extended so as nearly to cover the right parietal bone. On dissection, it was found to be filled with coagulated blood, beneath which was a layer of dense fibrinous matter. The right parietal bone presented a fissure with clean edges running from the coronal suture obliquely backwards and upwards. On the inner surface of the bone was an effusion of blood between the cranium and dura mater more than half an inch in thickness, and occupying the whole of the hollow of the parietal bone. There was no reason to doubt that the fracture and effusion were the results of compression during delivery. They had not been occasioned by external violence. (Trans. of Med. Chir. Soc. vol. 28. See for further information on this subject, Churchill on the Diseases of Children, p. 66.)

Fractures of the skull.—The only injuries which require to be specially considered in relation to infanticide, are fractures of the skull; and here the question to which we may confine our attention is, whether the fracture arose from accident or criminal violence. Although it has been a matter of frequent observation, that great violence may be done to the head of a child during parturition, without necessarily giving rise to fracture, yet it is placed beyond all doubt that this injury may occur by the expulsive efforts of the uterus forcing the head of a child against the bones of the pelvis. Even the violent compression which the head sometimes experiences in passing the mouth of the uterus, may suffice for the production of fracture. (See Ed. M. and S. J. vol. 26. p. 75.) Until within the last few years, it had been generally supposed that fractures of the cranium in new-born children were always indicative of criminal violence; but the cases collected by Dr. Schwörer of Freiburg, and others, have established the certainty of their accidental occurrence. These accidental fractures, it is to be observed, are generally slight; they commonly amount merely to fissures in the bones, beginning at the sutures, and extending downwards for about an inch or less into the body of the bone. According to Dr. Weber, the frontal and parietal bones are the only bones liable to be fissured or fractured during the act of parturition. (American Jour. Med. Sci. Jan. 1853, p. 254., and American edition of this work, by Dr. Hartshorne.) In the greater number of cases reported, the parietal bones only have presented marks of fracture.

The following cases occurred to Dr. Schwörer while performing his duties at the Obstetric Institution:—A child was still-born; he received it into his hands at birth, so that the head could have sustained no outward violence. On inspection, the skin over the summit was found swollen; and on removing it, there was a large effusion of blood beneath, especially over the right parietal bone. The bone was fractured or fissured in two places. Blood in a half-coagulated state was found beneath the fissures, between the bone and the dura mater, as also between this and the tunica arachnoides. (Beit. zur Lehr. v. d. Kindermord, Freiburg, 1836.) Here, then, were all the signs indicative of external violence; and possibly, had this woman been delivered in secret, and the body of the child found in a concealed place, she might have been charged with the murder. A second case is reported in Casper's Wochenschrift (Oct. 1840), in which about half a drachm of blood was effused on the right parietal bone, which was compressed in the centre, and presented a radiated fracture. Coagula were found on the dura mater. (See also B. and F. Med. Rev. vol. 21. p. 254, and vol. 7. p. 333.) In a third case, where there was deformity of the pelvis, the child was born dead, and there were two fissures about an inch long, in the left parietal bone; and both parietal bones were considerably flattened. (Casper's Wochenschrift, Sept. 1837.) Dr. West has reported the following case of spontaneous fracture of the left parietal bone, which occurred to Dr. Götz, during a natural but tedious labour, in which the head of a child was five hours in the pelvic cavity, although the pelvis was well formed. There were three fissures in the bone: one running into the sagittal suture, one to the anterior inferior angle, and the other to the middle of the anterior edge of the bone. The child was still-born. Much blood was effused beneath the scalp, but none under the skull. (Med. Gaz. vol. 39. p. 288.)

In respect to these accidental fractures and extravasations, it may be remarked that they are in general recognised by their very slight extent. In cases of murder by violence to the head, the injuries are commonly much more severe: the bones are driven in,—the brain protrudes, and the scalp is extensively lacerated. Such severe injuries as these cannot arise accidentally from the action of the uterus during parturition. (See report of a case by Dr. Wiseman, in which, in addition to severe injuries to the brain, coal-dust and minute pebbles were found driven into the skin of the head by the body being thrown from a height. (Ed. Med. Jour., Dec. 1855, p. 492.) In these cases, however, it may be fairly urged, that the woman was unexpectedly seized with labour, that the child was expelled suddenly by the violent efforts of the uterus, and that the injuries might have arisen from its head coming in contact with some hard surface—as a floor or pavement. It must be admitted, that a woman may be thus suddenly and unexpectedly delivered while in the erect posture, although this is not common among primiparous females; and that injuries may be thus accidentally produced on the head of a child.

Sudden delivery in the erect posture.—A case of sudden delivery in the erect posture in a primiparous female, without injury to the child, is reported by Dr. W. Burke Ryan, in the Lancet. (June 21, 1845, p. 707.) The umbilical cord was in this instance ruptured at the distance of about two inches from the navel. This gentleman has communicated to me the particulars of a second case, which occurred in his practice in Oct. 1852. A woman who had borne a child was suddenly delivered while standing. The child fell to the floor on its vertex, and the cord was ruptured. A small quantity of blood escaped from the part struck, but there was no open wound or fracture of bones. The child sustained no injury. In another case of a primiparous female, sudden delivery took place while the woman was in the act of sitting down. The child was forcibly expelled, and fell with its head on the floor of the room. It was taken up dead, the cord being still attached to it and the placenta, which came away shortly after the birth of the child. (Med. Gaz. vol. 37. p. 808.) It appears from cases collected by Dr. Klein, that fractures of the cranium under these circumstances are of rare occurrence. Out of one hundred and eighty-three cases reported by him in which the women were rapidly delivered while sitting, standing, or inclined on the knees,—the child falling on the ground or floor, there was only one instance in which a child was killed; and there was not a single instance in which the bones of the cranium were fissured or fractured, so far as could be ascertained by external examination. (Devergie, t. i. p. 631; Briand,

p. 271.) Chaussier performed some experiments on the bodies of still-born children, allowing them to fall with their heads downwards on a paved floor, from a height of eighteen inches: and he found that out of fifteen cases one or other of the parietal bones was fractured in twelve. Although these results are conflicting, yet Klein's observations appear more to the purpose; because they were made under circumstances in which the question would really arise in a case of infanticide. They are strikingly supported by the following case, which occurred to Mr. Blacklock. (Lancet, July 26, 1845.) A married woman was suddenly delivered while standing:—the child fell to the floor, but sustained no injury. The umbilical cord was ruptured close to the umbilicus. (See also Dr. Ryan's case, *supra*.) A case analogous to these, also in a primipara, is reported in the Gazette Médicale, 26 Juin, 1847. A woman, æt. 27, was delivered of a child while in the act of walking to the hospital, at the distance of a mile. She stated that she had lost a large quantity of blood. The child, which she brought in her apron, was mature and living: the navel string had been ruptured close to the abdomen. (See also another case by Dr. Pickford, Med. Gaz. vol. 42. p. 731.) A more recent case has been reported by Mr. Dermott. (Lancet, March 12, 1853, p. 245.) A young married woman, æt. 23, pregnant of her first child, was delivered suddenly while in the erect posture. The child, which was healthy and full-grown, fell upon the floor, and the cord was broken off within three inches of the navel. It was separated as cleanly as if it had been divided by an accoucheur. Excepting the production of a swelling on the forehead from a bruise, the child had sustained no injury by this sudden expulsion. A similar case occurred to Dr. Chevers. (Med. Jur. for India, 1856, p. 523.) These observations lead to the inference that such accidents are not likely to occur, yet we cannot deny the *possibility* of their occurrence: therefore a barrister is fully justified in endeavouring upon this ground to exculpate a person charged with child-murder.

Dr. Swayne, of Bristol, has published in the Association Journal (Oct. 14, 1853, p. 901) a case which shows that a fracture of the skull of a child may occur when a woman is delivered in the erect posture. In this case, there was merely the appearance of a bruise on the head: the cord was ruptured (not cut) three inches from the navel. The child did not suffer from the fall, and continued well until six days after its birth, when it was seized with convulsions and died. A fissure of about an inch and a half in length was found in the upper part of the left parietal bone. A clot of blood was found in this situation, between the dura mater and bone, and there was congestion of the vessels of the membranes: with this exception there was no morbid appearance in the body. Dr. Porter

Smith, of Bath, has communicated to me a case which occurred in November, 1856, in which the facts were similar to those above related. In consequence of the concealment of the body, however, the mother was charged with the murder. The right parietal bone was fractured, and there was effusion of blood internally, but there was no mark of external violence. The cord had been ruptured at a distance of two and a half inches from the navel. The stomach of the child contained the usual albuminous and mucous matters of the fœtal state, without any appearance of food. The lungs were inflated and highly crepitant. The foramen ovale and the ductus arteriosus were in their fœtal condition. The child had probably been drowned in the discharges from want of assistance at the time of birth. The woman was acquitted. She admitted that the child fell from her suddenly. Dr. Olshausen has published four cases of sudden delivery, in which the child dropped from the woman, and in two of these there were fissures in the parietal bones. Both children recovered from the effects of the accidents. (Med. Times and Gazette, Sept. 1860. Am. Jour. Med. Sci. Jan. 1861, p. 279.) Other cases of rapid delivery in the erect posture are reported in the Lancet. (Jan. 5, 1861, p. 13.) In these there was no injury to the child, although in one case the delivery took place on the deck of a vessel.

A medical witness would find no difficulty in determining the probability of this explanation of the accidental origin of such fractures, if he were made acquainted with all the facts connected with the delivery. But the acquisition of this knowledge must be accidental; and it will in general be out of his power to obtain it. Sometimes the fractures will be accompanied by incisions, punctures, or lacerations of the scalp or face: — in this case, although the origin of the fractures might be accounted for by the alleged fall during parturition, the cause of the other injuries would still remain to be explained. (See the case of the *Queen* v. *Reeve*, Cent. Crim. Court, Feb. 1839. The *Queen* v. *Stevens*, Bodmin Lent Ass., 1845.) Injuries of this nature, with the fact that there are bruises or contusions, as well as fractures not connected with each other in various parts of the skull, would be inexplicable on the hypothesis of an accidental fall. I am indebted to Mr. Kesteven, of Holloway, for the following case. An inquest was held in Feb. 1854, on the body of a female infant, of which a young woman had been delivered on the 21st of December, 1853. The infant had been born, according to the statement of the mother, in the pan of a water-closet on the ground floor of the house, and was afterwards carried by her up two pairs of stairs, and placed beside her in bed. She admitted that the child had been born alive, but stated that it was dead when she lifted it up from the pan to carry it to the bed-room. The navel string was torn at the distance of four inches from the abdomen. The child, she alleged, had fallen into the water-closet pan. No trace, however, of blood or other discharge was found on or near the seat of the closet, while upon the opposite side of the chamber the floor was stained with blood, which had been imperfectly wiped up. On an examination of the body of the infant, it was found to be a well-formed mature child, weighing seven pounds. The lungs had been fully expanded to their margins, covering the heart, and floating in water with or without the latter organ. The scalp presented no trace of injury. The usual tumour of the scalp was apparent. On dividing the scalp, there was some ecchymosis at this part. The bones of the skull were found extensively fractured. There was a horizontal fracture nearly an inch long over each orbital prominence; upon the right frontal eminence the bone was broken and depressed, in an acute triangular form, three quarters of an inch in length: the parietal bones on each side were fractured vertically from their eminences downwards to the extent of an inch and a quarter; on the left side the lower end of this fissure was joined by another of similar extent, passing horizontally forwards at a right angle to the edge of the bone. Several minor fractures were found at different parts of the upper surface of the skull; they were not apparently connected with each other. Within the cranium, blood was extravasated on the surface of the brain, and in the membranes. No fractures were detected at the base of the skull. The mother alleged that the injuries to the head were owing to the child having fallen into the pan of the water-closet. This explanation, however, was inadmissible, as it was very doubtful whether the body of the child had been in the pan at all. Even supposing the child to have thus fallen, the distance was too small to have caused such an amount of injury situated on various parts of the skull: besides which, as the child would have passed in an oblique direction forwards from the outlet, it would have glided safely down the side of the pan. In the absence of evidence as to the mode in which the injuries were inflicted, it was suggested that they might have been caused by the mother having fallen upon the child on her way up stairs; and this hypothesis was ultimately adopted by the coroner's jury. There was no doubt that the child's death was caused by the injuries to the head: and the jury took, what is called, a lenient view of the facts, in rejecting the woman's explanation of the cause of the violence, and in assuming that such a variety of severe injuries to the bones of the head could have been produced by the mother falling upon the body of the child. (See another case in Med. Times and Gaz., April 4, 1857, p. 347.)

The medico-legal importance of this subject will be further apparent from the evidence given in a case tried before the Criminal Court of New York, in November, 1834. (Med. Gaz.

vol. 18, p. 44.) One of the medical witnesses in this case positively denied that the bones of the head could be fractured by the action of the uterus during parturition! It appeared highly probable that the fracture had been here occasioned by the accidental fall of the child during delivery; and the prisoner was acquitted. Dr. Wharrie has published a case, also the subject of a criminal charge, in which it is probable that a fracture of the head of a child was produced by the expulsive action of the uterus. The body had been found secretly buried. It was fully developed, but had evidently not breathed. The navel-string had been cut and tied; six inches of it still remained attached to the body. On the left side of the cranium, near the vertex, there was a small effusion of blood; and on removing this, a fissure half an inch in length was found in the edge of the left parietal bone, close to the line of the sagittal suture, and near the posterior fontanelle. On shaving off the hair, there was no discolouration, nor any mark on the skin indicative of a blow. There was no evidence to show that any violence had been used to the child at its birth, and from the description of the fissure it was a fair presumption that it had arisen during delivery from the muscular contractions of the uterus. (Cormack's Monthly Jour. Nov. 1845, p. 847.)

The possible occurrence of an injury of this kind has been strained, in several cases of child-murder, to explain the origin of fractures which, however, could not be fairly assigned to such a cause. A case was tried at Glasgow, in April, 1852 (case of *Ann Irwin*), in which Dr. Easton gave evidence. There was no doubt, from the state of the lungs, that the child had fully breathed, and there was violence to the head which satisfactorily accounted for death. The whole extent of the right side of the head was deeply ecchymosed, and there was a considerable amount of coagulated blood lying between it and the cranium. In the centre of the right parietal bone, there was a fracture extending across the vertex for fully four inches, and involving a part of the parietal bone on the opposite side. The fracture was a continuous even line, not radiated and not depressed. The pericranium, bones, and soft parts in the track of the fracture, were deeply ecchymosed, while on the surface of the brain, particularly on the right hemisphere, there was a copious effusion of clotted blood. It was impossible to refer severe injuries of this kind to the action of the uterus in delivery, or to violence applied after death. The prisoner alleged that the child was still-born. (See Edinburgh Monthly Jour., June, 1825.) In the case of the *Queen* v. *Mussett* (Bury Lent Assizes, 1856), the head of a child was almost flattened from the violence sustained. It was clear that no fall or other accident could explain this condition. Some fresh blood and a single hair were found on a shelf in the cellar, for which the prisoner accounted by stating that she had there killed a rabbit. A microscopical examination, however, showed that it was a human hair. The medical evidence established from the state of the lungs that the child had breathed, and that it had had an independent existence. The prisoner was convicted.

Length of the umbilical cord.— It has been recommended on these occasions, that we should observe the length of the umbilical cord, and notice whether it is cut or lacerated, as these facts may, it is presumed, throw some light on the question. But a medical witness can seldom procure the cord for examination, although it will generally be in his power to ascertain whether it was cut or lacerated, by examining the portion which is attached to the body of the child. The cord varies in length,— the average being from eighteen to twenty inches: but it has been met with so short as six inches (Lancet, June 13, 1846, p. 660), and even five inches. (Lancet, July 11, 1846, p. 49.) In a twin case which occurred to Mr. Stedman, of Guildford, the cord was only *four inches* long. (Lancet, Aug. 28, 1841.) On the other hand, in one instance, where it was found twice twisted round the child's neck, it was fifty-three inches long. Dr. Churchill found, out of three hundred and ninety-one cases, that the shortest cord was twelve inches, and the longest fifty-four inches in length. In a case reported by Mr. Wood it was sixty-one inches long, and coiled twice round the abdomen of the child. (Med. Gaz., vol. 45, p. 263.) As the whole of the cord can rarely be obtained, it is unnecessary to discuss the question, whether it were long enough to admit of the falling of the child without rupture. It has been remarked, that when the cord is ruptured from accidental causes during delivery, the rupture takes place either very near to the placental or the umbilical end. In twenty-one of the cases observed by Klein, it was found to have been forcibly torn out of the abdomen; but it may be torn or lacerated at any part of its length, although the rupture is commonly observed near to one extremity. Among the four cases of sudden delivery reported by Dr. Olshausen (page 501), the cord was torn through at three inches from the navel in one, and no bleeding followed. In two the cord was torn through its middle, and at first there was great bleeding. In three it was torn close to the umbilicus, and no bleeding had occurred. In four the cord was torn at five or six inches from the navel, and there was no bleeding, although it remained untied for ten minutes. In *Reg.* v. *Martin* (Lewes Lent Assizes, 1860), the medical witness was closely examined by the judge whether rupture of the cord might not lead to fatal bleeding. The above facts show that a rupture of the cord is not necessarily fatal, even when the circumstances are unfavourable. It does not appear how the examination of the cord can throw any light upon the origin of these fractures of the cranium.

Injuries accidentally sustained in utero.—A practitioner must remember that if, while in an advanced stage of pregnancy, a female should accidentally fall, the child may sustain injury by a blow through the abdominal parietes. This is not to be strained into a specious defence for violence which has obviously occurred subsequently to birth, but the fact itself is of sufficient importance to merit attention, as the following case will show:—A pregnant woman, within five days of the ordinary term of gestation, fell while running, so that her abdomen struck sharply against an angular stone. There was an immediate loss of blood, and the movements of the child ceased. Four days after the accident parturition came on. Dr. Stanelli found the head of the child much enlarged, and in a putrid state. The female died in an hour. On examining the child, the skull was found almost crushed, the parietal having become separated from the temporal bones as if by external violence. The marks of injury were entirely limited to the head. (Gazette des Hôpitaux, Nov. 7, 1846, p. 523.)

In accidents of this kind it is most probable that the child would be born dead. There might also be marks of violence on the abdomen of the mother. Some observers have described cases in which the limbs of the fœtus in utero have become deeply indented or spontaneously amputated, by the twisting of the umbilical cord around them. (Dublin Hospital Gazette, Jan. 1846, p. 153.) It is not possible that these or other accidental injuries before birth, could ever be mistaken for violence inflicted on the body of a child after its birth. A remarkable case of this kind has been communicated to the Med. Times and Gaz. (Dec. 10, 1853, p. 604) by Mr. Maclauglin, in which a child was born without limbs. It is difficult to account for the occurrence of such a singular case as this: but practically it could have occasioned no medico-legal difficulty, had the body of the child been found dead, since the absence of the limbs could not have been referred to an act of mutilation. Dr. H. Barker, of Bedford, has directed attention to the subject of intra-uterine fractures, in their pathological and medico-legal relations. He advises that the bones of the body should be examined, in reference to their strength, osseous development, and other physical characters. It will probably be found, as in fractures in adults from slight causes, that the bones are preternaturally brittle (*ante*, p. 370). In this case, due allowance should be made for the occurrence of an intra-uterine fracture, as the result of a fall during pregnancy. (On Intra-uterine Fractures, p. 21. 1857.)

Defective ossification simulating violence.—In reference to injuries of the bones of the head in a new-born child, it may be proper to mention the particulars of a case which was referred to me by Mr. Lord, in 1847. The dead body of a new-born child, wrapped in brown paper and a towel, was found in a pond. Mr. Lord examined it for the coroner's inquest. The head was much decomposed, and the scalp was extensively lacerated and destroyed over the parietal bones, which readily separated. The brain was reduced to a bloody pulp. The umbilical cord, which had not been tied, was cut obliquely at about six inches from the navel. The lungs, which were very crepitant, readily floated on water, and bore up the heart. The body was generally bloodless. The point of difficulty which the case presented, consisted in the presence of two apertures on one parietal bone. These apertures were small and rounded, and it was at first doubtful whether they had not been wilfully produced by some perforating instrument applied to the head. It was remarked that one aperture was situated near the temporal ridge, and in this situation the scalp was entire and uninjured. The other was situated in that part of the bone which corresponded to the lacerated portion of the scalp. It was ascertained that no violence had been used in the removal of the body from the water. The bone was macerated, and carefully examined by the aid of a lens. It was then perceived that the apertures were quite regular at the edges, which were remarkably thin, evidently passing into a membranous condition. The internal table was also deficient, so that, from the interior, the bone was bevelled off gradually from each aperture. This examination left no doubt that the holes in the bone were not due to any mechanical violence applied during life, but to deficient ossification. These spaces had been membranous, and the membrane destroyed by decomposition. The putrefaction of the scalp, and its separation, might have been accelerated by a bruised condition of these parts during a difficult labour.

Twisting of the neck.—Children are sometimes destroyed in the act of birth by the neck being forcibly twisted, whereby a displacement of the cervical vertebræ, with injury to the spinal marrow, may occur, and destroy life. Such injuries are immediately discovered by an examination. It should be remembered, however, that the neck of a child is very short, and that it always possesses considerable mobility.

Violence in self-delivery.—When the marks of violence found on the head, neck, and body of a child cannot be easily referred to an accidental fall, it is common to ascribe them to the efforts made by a woman in her attempts at *self-delivery*, and without any intention on her part of destroying life. The rules to guide a medical opinion in such a case must depend upon the nature, situation, and extent of the injuries: and each case must be therefore decided by the circumstances attending it. (The *Queen* v. *Horder*, Abingdon Summer Ass., 1840.) This should be contrasted with two other cases (the *Queen* v. *Trilloc*, Here-ford Summer Ass., 1842; *Queen* v. *Turner*, Worcester Winter Ass., 1843.) In the two first cases, the children were admitted to have been living;—in the one the violence was chiefly confined to the head, and the prisoner was acquitted,—in the other the marks of violence were upon the neck, and the prisoner was convicted. These cases show the uncertainty attendant on a plea of this kind. (See also two other instances, Brit. and For. Med. Rev. vol. 8. p. 521.) Sanguineous tumours simulating fractures are sometimes found on the heads of new-born children. These depend on natural causes, and must not be confounded with marks of violence. (Med. Gaz., vol. 36. p. 1082.) They may be known by the unruffled state of the skin. A medical witness, however, must be prepared to allow that a woman at the time of her delivery, may from pain and anxiety become deprived of all judgment, and may destroy her offspring without being conscious of what she is doing. It is therefore a sound principle of law that mere appearances of violence on a child's body, are not *per se* sufficient, unless there is some evidence to show that the violence was knowingly and intentionally inflicted, or the appearances are of such a kind as of themselves to indicate intentional murder. (Alison.) The benefit of a doubt will always be given in favour of the accused. See PUERPERAL MANIA, *post.*

Conclusions.—The conclusions to be derived from the contents of this chapter are:—

1. That a new-born child may die from violent causes arising from accident.

2. That some forms of violent death are not necessarily attended with external signs indicative of violence.

3. That a child may be accidentally suffocated during delivery.

4. That the usual marks of death from drowning are not apparent, except in children which have breathed.

5. That the state of the umbilical cord may often furnish important evidence.

6. That some females recently delivered may have strength to exert themselves and walk great distances.

7. That a new-born child may speedily die from exposure to cold and privation of food.

8. That slight fractures of the bones of the cranium may arise from the action of the uterus on the head of the child during delivery.

9. That females may be unexpectedly delivered while in an erect posture: the umbilical cord is, under these circumstances, sometimes ruptured, and the child may sustain injury by the fall.

10. That the violence found on the body of a child may be sometimes referred to attempts innocently made by a female to aid delivery.

CHAPTER 47.

DEATH OF THE CHILD FROM STRANGULATION — DECEPTIVE APPEARANCES ON THE BODY. — STRANGULATION BY THE UMBILICAL CORD—DIAGNOSIS.—ACCIDENTAL MARKS RESEMBLING THOSE OF STRANGULATION—CONSTRICTION BEFORE AND AFTER DEATH — BEFORE AND AFTER RESPIRATION — CONSTRICTION BEFORE AND AFTER ENTIRE BIRTH — BEFORE AND AFTER THE SEVERANCE OF THE UMBILICAL CORD.— CONSTRICTION WITHOUT ECCHYMOSIS — EXAMINATION OF THE MOTHER — SUMMARY OF MEDICAL EVIDENCE — DEATH OF THE CHILD AFTER BIRTH FROM WOUNDS DURING DELIVERY — GENERAL CONCLUSIONS.

Among the forms of violent death which are almost always attended with appearances indicative of criminal design are the following: —

7. *Strangulation.*—The destruction of a new-born child by strangulation is not an unfrequent form of child-murder: and here a medical jurist has to encounter the difficulty, that the strangulation may have been accidentally produced by the twisting of the umbilical cord round the neck during delivery. We must not hastily conclude from the red and swollen appearance of the head and face of a child, when found dead, that it has been destroyed by strangulation. There is no doubt that errors were formerly made with respect to this appearance: for Dr. Hunter observes,—"When a child's head or face looks swollen, and is very red or black, the vulgar, because hanged people look so, are apt to conclude that it must have been strangled. But those who are in the practice of midwifery know that there is nothing more common in natural births, and that the swelling and deep colour go gradually off if the child live but a few days. This appearance is particularly observable in those cases where the navel-string happens to gird the child's neck, and where its head happens to be born some time before its body." — Op. cit. p. 27.) Strangulation by the umbilical cord can of course refer to those cases only in which the cord becomes firmly twisted round the neck *after* the respiratory process is established, and this is rather a rare occurrence: because death more commonly takes place by compression of the cord under these circumstances, and by the consequent arrest of circulation before the act of breathing is performed The only internal appearance met with in death from this cause, is a congested state of the cerebral vessels. The appearance of ecchymosis on the scalp, as well as lividity of the face, is very common in new-born children when the labour has been tedious and difficult; and, therefore, unless there were some marks of injury about the neck, this would not justify any suspicion of death from strangulation.

Strangulation by the umbilical cord.—It has been supposed, that the strangulation produced by the wilful application of any constricting force to the neck, would be known from the accidental strangulation caused by the cord, by the fact that in the former case there would be a livid or ecchymosed mark or depression on the neck. But it may be objected to this view, that such a mark, although, from the great violence used, a common, is not a constant accompaniment of homicidal strangulation. On the other hand, although it was formerly a disputed question, it is now certain that the umbilical cord may itself produce, in some instances, a livid or ecchymosed depression. Among various cases which may be quoted in support of this view, is the following reported by Mr. Foster. In April, 1846, he was summoned to attend a lady in labour with her first child. Owing to the size of the head, the labour was of a lingering kind, and the child came into the world dead. The umbilical cord was found coiled three times round the neck, passing under the right armpit, and upon removing it, *three parallel discoloured depressions* were distinctly evident. These extended completely round the neck, and corresponded to the course taken by the umbilical cord. The child appeared as if it had been strangled. (Med. Gaz. vol. 37. p. 485.) Had this child been born secretly, this state of the neck might have created a strong suspicion of homicidal violence. Strangulation after birth could not, however, have been alleged, because there would have been no proof of respiration. When a blue mark is found on the neck of a child whose lungs retain their fœtal characters, it is fair to presume, *cæteris paribus*, that it has been occasioned accidentally by the twisting of the umbilical cord during delivery. Mr. Price has communicated to the same journal the account of a case in which the cord was so tightly twisted around the neck of a child, that he was compelled to divide it before delivery could be accomplished. There was in this case a deep groove formed on the neck, and it conveyed the impression to himself and a medical friend, that in the absence of any knowledge of the facts, they would have been prepared to say that the child had been wilfully strangled by a rope. (Med Gaz. vol. 38, p. 40.) In this instance the cord was short. A diagnosis might have been formed, as in the preceding case, by examining the state of the lungs. Dr. Mutter met with a case in which a child was born dead, and the cord was tightly twisted round its neck: — when removed, the neck exhibited a livid circle of a finger's breadth, smooth and shining; but on cutting into this mark, no subcutaneous ecchymosis was found. (North. Jour. Med. Jan. 1845, p. 190.) In *Reg.* v. *Martin* (Lewes Lent Assizes, 1860), the material question was, whether a mark round the neck had been caused accidentally by the umbilical cord: this was denied by the medical witness. This question also arose in another important case, to which I can only here refer, *Reg.* v. *Pyne* (Gloucester Winter Assizes, 1858).

Dr. Williamson, of Leith, has directed attention to an important fact connected with the state of the lungs in a new-born child, and the medical opinions which may be expressed from their condition as furnishing evidence of live birth. Referring to Mr. Price's case, in which the cord was tightly twisted round the neck of the child, he states that in similar cases which have occurred to himself, the child has breathed immediately on the birth of the head; but, owing to the shortness of the cord, the child would have been strangled and born dead unless he had divided the cord. Thus, then, a child might die apparently strangled, and not be born alive, although it may have so breathed during delivery that the lungs will present all the characters of respiration. If the circumstances were not known, a medical man might be led to say that the child had been born alive, and had died from strangulation. (Ed. Med. Jour. Feb. 1858, p. 714.)

From two of these cases it will be perceived that by trusting to ecchymosis in the mark as an absolute means of distinction between constriction produced by criminal means, and that which results accidentally from the umbilical cord, a serious error may be committed. As in the following case (reported in the Ann. d'Hyg. 1841, t. 1. p. 127), a female charged with the murder of her child by strangulation may be unjustly condemned. The child had fully and perfectly respired :—the lungs weighed one thousand grains, and, when divided, every portion floated on water, even after firm compression. There was a mark on the neck, which was superficially ecchymosed in a part of its course. From an investigation of the facts, this appeared to have been a case in which the mark was produced accidentally by the umbilical cord, during attempts at self-delivery on the part of the woman, *i.e.* by her manipulations with the cord. She was, nevertheless, convicted, and condemned to a severe punishment. The case establishes three points: 1, that partial ecchymosis may be produced on the neck by the umbilical cord being twisted around it; 2, that this may lead to the accidental strangulation of a child after it has breathed at the outlet,—the cord was twenty-four inches long: 3, that a child's lungs may in a *few seconds* become sufficiently distended with air to give satisfactory evidence of respiration with the pulmonary tests. In the same journal, p. 428, will be found the report of another case, suggesting many important reflections in regard to the medical jurisprudence of infanticide. In this instance, the umbilical cord and membranes were actually used by the female as a means of strangulation: the child had not breathed, but was thereby prevented from respiring. There was superficial ecchymosis on each side of the neck over the sterno-cleido-mastoidei muscles. The defence was, that the child was born with the cord around its neck, and that it was from this circumstance accidentally strangled; but the medical evidence tended to show, that the cord had been violently stretched, and used as a means of strangulation. The child had *not breathed*, and the witnesses considered it to have been born dead, owing to the violence used by the woman. The cause of death here was certainly not strangulation, but arrested circulation. In the mean time, the case proves that ecchymosis (a blue mark) may be the result of the constriction produced by the cord. See the case of *Reg.* v. *Martin*, Lewes Lent Assizes, 1860. (For additional remarks on this subject, see Henke's Zeitschrift, 1837, vol. 4. p. 352; also Ed. M. and S. J. Oct. 1838, p. 282; Casper's Vierteljahrsch. 1859, vol. 2. p. 55.) A case occurred to Mr. M'Cann, in September, 1838, in which the umbilical cord, which was of its full length, had been used as the means of strangulation. It was twisted once round the neck, passed under the left arm over the shoulders, and round the neck again, forming a noose or knot, which, pressing upon the throat, must have caused strangulation, as the tongue was protruded, and there were other clear indications of the child having been strangled. The hydrostatic test applied to the lungs proved that respiration had been performed.

Distinction.—When the mark is deep, much ecchymosed, and there is extravasation of blood beneath, with ruffling or laceration of the skin, it is impossible to attribute this to the accidental position of the umbilical cord. The lividity produced by the cord in the cases hitherto observed has been only slight and partial, and unaccompanied by laceration of the skin, or injury to deep-seated parts. (For an instructive case by Dr. Scott, in reference to this point, see Ed. M. and S. J. vol. 26. p. 62.) On the other hand, in homicidal strangulation, much more violence being used than is necessary for destroying life, we may commonly expect to find great ecchymosis and extensive injury to the surrounding soft parts. On some occasions all difficulty is removed by the discovery of a rope, tape, or ligature round the neck; or if this be not found, the proofs of some ligature having been used will be discovered in the indentations or irregularly ecchymosed spots left on the skin; the depressed portions of skin being generally white, and the raised edges livid.

It is questionable whether a child can be born with the umbilical cord so tightly round the neck as to produce great depression of the skin and ecchymosis, *i.e.* to simulate homicidal strangulation, and at the same time perform the act of respiration fully and completely. It is important, therefore, when this hypothesis is raised in order to account for a suspicious mark on the neck, to examine closely the state of the lungs. Unless the cord be designedly put round the neck of the child *after* the head has protruded, the effect of the expulsive efforts of the uterus, when a coil had become *accidentally* twisted round the neck, would be to tighten the cord, compress the vessels, and kill the child, by arresting the maternal circulation, at the same time that this pressure would effectually prevent respiration. The lungs, as in the cases above cited, should present the appearances met with in still-born children. This point is frequently lost sight of in medical evidence, and marks produced by ligatures wilfully applied are set down as having been caused by the cord. In the case of *Reg.* v. *Pratley* (Oxford Summer Ass., 1853), the mark on the child's neck was attributed to the navel-string. In the case of *Reg.* v. *Robinson* (Lewes Summer Ass., 1853), there was the mark of a ligature round the neck, which had been *tied very tightly*,—the child had fully breathed, and according to the medical evidence, it had died of strangulation. The strangulation was referred to an accidental twisting of the cord during delivery. It is to be feared that this kind of defence is too readily accepted by medical witnesses in cross examination. In examining a suspicious mark round the neck of a new-born infant, it is desirable to notice whether it does not, by its form or course, present some peculiar indentations which may render it certain that a ligature had been employed after birth. When it is found that a child has fully respired, the presence of a deeply ecchymosed mark on the neck is, *cæteris paribus*, presumptive of homicidal strangulation. Death from accidental constriction of the cord should, as a general rule, leave the lungs in their fœtal condition.

Marks on the neck may be produced by the umbilical cord without necessarily destroying the child's life. Two cases of this kind are reported by Prof. Busch. (Br. and For Med. Rev. vol. 10. p. 579.) Or the child may be destroyed without ecchymosis being a necessary consequence of the constriction produced by it. (See case by Dr. Hauff. Henke's Zeitschrift, 1836, Erg. 11.) There is much less risk of strangulation from twisting of the cord than is commonly believed. Out of one hundred and ninety cases, Dr. Churchill found the cord round the neck in fifty-two children. The shortest cord so disposed was eighteen inches long, and it occurred twice in seventy-five cases. Insulated or detached marks of ecchymosis, as from local pressure, cannot be set down to the twisting of the navel-string. Other accidental causes may here come into operation. In the case of *Reg.* v. *Sampson* (Bodmin Lent Assizes, 1853), it was proved that there was a mark on the neck of the child, and it was charged against the prisoner that this had been caused by pressure of the fingers, *i. e.* by pinching the windpipe. The mark was described as being red and inflamed, and an inch and a quarter in length. It was suggested in defence, that the mark might have been produced by the tying of a cap. The medical witness stated that it was below the spot where a cap would be generally tied, but the mark might by possibility have been occasioned by the knot of the tie. The prisoner was acquitted. In admitting this kind of defence, it is to be observed that the tying of a cap may actually be made the means by which death by strangulation is effected.

Accidental marks resembling those of strangulation.—In the fore part of the neck of a child a mark or depression is sometimes accidentally produced by forcibly bending the head forwards on the chest, especially when this has been done repeatedly and recently after death. It may occur also as an accident during labour. Such a mark must not be mistaken for the effect of homicidal violence. It has been a question whether, independently of the constriction produced by the cord, the neck of the uterus might not cause, during its contractions, an ecchymosed mark on the neck. I am not aware that there is any case reported which bears out this view; and it seems highly improbable that any such result should follow.

The discoloration may be in detached spots or patches,—situated in the fore part of the neck, and evidently not arising from the employment of any ligature. These marks may depend on the forcible application of the fingers to the fore part of the neck of the child, and the indentations have been known to correspond,—a fact which has at once led to a suspicion of the cause of pressure and the mode of death. It may be alleged in defence, that such marks might have been accidentally produced: 1. By the forcible pressure produced by the child's head during labour, an explanation which is highly improbable, if respiration has been performed—although a child has been known to breathe in breech-presentations, while the head was still in the vagina. 2. They will be more commonly referred to a violent attempt made by a woman at self-delivery, during a paroxysm of pain. This explanation is admissible, so long as it is confined to injuries probably received during labour; but supposing the marks to have been certainly produced after birth, it will not of course apply. The following case (the *Queen* v. *Ancliffe*, Nottingham Lent Assizes, 1842), is in this respect worthy of attention; for it appears to me to show that a defence of this kind may be sometimes strained:—The evidence proved that the prisoner was delivered of a child, under much suffering, on a stone floor, and in the presence of another woman,—a witness. The child was born alive, and was heard to cry several times. The witness left it in charge of its mother, and on returning shortly afterwards, she found it dead, with black marks upon its throat. The female midwife, who separated the child from the mother, deposed that it gave a sort of half-cry;—she thought it was dead when she first saw it, and the marks on the neck were not more than a woman might have caused in attempting to deliver herself. The medical evidence showed that there were many ecchymosed marks about the throat of the child, and on the right side of the neck, blood was effused. The marks may have been produced by the fingers: — death had been caused by pressure on the windpipe. The judge left it to the jury to say, whether the marks of violence might not have been unconsciously inflicted by the prisoner during labour. The jury returned a verdict of not guilty. (See also a case by Bellot. Ann. d'Hyg. 1832, vol. 2, p. 205.)

In *Reg.* v. *Parkinson* (Liverpool Lent Assizes, 1859), some suspicious marks were referred to the tightening of the string of the child's cap. It is obvious from numerous acquittals that a jury are ready to act upon any suggestions to account for marks of violence on the body of a new-born child. In *Reg.* v. *Ashton* (Lewes Lent Ass. 1858), it was proved by the medical evidence that the child was found dead in the soil of a privy with a piece of riband tied tightly round the neck, — the mark of a bruise on the head, — two deep cuts in the throat, and about seventeen punctured wounds on the body, of which one had penetrated the heart. The medical witness stated he had no doubt the child was born alive and that these injuries were the cause of death. The counsel in defence suggested that there was no proof of existence after entire birth of the body, and the injuries found on the child were "very probably the result of accident in the course of self-delivery by an unhappy young creature like the prisoner!" The jury accepted this view of the facts and acquitted her of the murder. The cases of *Reg.* v. *Money* (Norfolk Summer Ass. 1858), and *Reg.* v. *Grady* (Liverpool Lent Ass. 1858), furnish additional illustrations of the impunity with which new-born children may be destroyed.

Among marks simulating violence, which are sometimes found on the necks of new-born children, Mr. Harvey has pointed out one of a very singular kind. In February 1846, he was present at a delivery in which a child was expelled rather suddenly: and after making two or three convulsive gasps, it died. Whilst endeavouring to restore animation, he observed a bright red mark extending completely across the upper and fore part of the neck, from one angle of the lower jaw to the other, as though it had been produced by strangulation with a cord, except that the mark was not continued round to the back of the neck. It was of a vivid red colour, and not like a bruise or ecchymosis: it had very much the appearance of a recent excoriation. It was most clearly defined in front, where it was about a quarter of an inch in breadth, and it became diffused at the sides. The face was not swollen, and there was no fulness of the veins. (Med. Gaz. vol. 37, p. 379.) The distinction here would have been based upon the colour of the mark — the unabraded state of the epidermis, and the absence of congestion of the face and venous system. Nevertheless, the case is of great importance, and the facts should be borne in mind, in the examination of the body of a new-born child alleged to have been strangled. Another case, which was the subject of a coroner's inquest, was published by Mr. Rose in the same journal (vol. 37, p. 530), in which red marks on each side of the nose of a new-born child were mistaken for the effects of violence applied to the nostrils during a supposed attempt at suffocation. Mr. Rose examined them closely, and considered that they were nævi, and had nothing to do with the death of the infant!

Constriction before or after death—before or after respiration.—A medical witness is sometimes asked to state on these occasions, whether the ligature or the fingers had been applied to the neck of the child before or after death,—or before or after it had breathed. It is proper to observe, that so far as the external marks of strangulation are concerned, there is no difference in the appearances, whether the constriction take place during life or immediately after death, while the body is warm. Casper's experiments render it highly probable, that when the constricting force is applied to the neck of a dead child at any time *within an hour* after death, the marks cannot with certainty be distinguished by any appearance from those made on a living body. (Wochenschrift, Jan. 1837.) With regard to the second point, it may be stated, that whether the child has breathed or not, provided it be *living*, the marks of violence present precisely the same characters. The following case is related by Casper:—The body of a new-born child was found concealed in a cellar, and the mother was charged with having murdered it. She confessed that she had heard the child cry at the birth, but that it soon died. In about an hour afterwards, she tied tightly round its neck a band made of a few straws, which she had hastily twisted together for that purpose, in order, as she alleged, "to prevent it from awaking." On the fifth day the body was examined; the child was mature, well formed, and had evidently breathed. The examiners referred death to strangulation; the woman was convicted, and sentenced to be imprisoned for life. An appeal was made against this sentence, and Casper's opinion was called for on the propriety of the medical inference of strangulation during life, from the mark on the neck. The witnesses had stated:—"that each straw in the band had produced a well-defined depression, which was whiter than the surrounding skin, while the little folds or elevations between the straws were red;—and on cutting into these reddened portions, slight ecchymosis was found beneath." Casper gave his opinion, that the slight ecchymosis observed, might have resulted from the application of the straw band soon after death,—while the body was warm; and the circumstantial evidence allowed that the ligature might have been applied at some time within an hour after death. Hence he declared that there was a want of proof that this child had died from strangulation. In consequence of this opinion the punishment was mitigated. It is impossible to deny the correctness of the inference drawn by Casper, since the mark was undoubtedly such that it might have been produced either before or recently after death. Which of these two suppositions was the more probable, and whether it was more likely that a ligature should be put round a child's neck an hour *after* death to prevent it from awaking (?), or *before* death for the alleged purpose of destroying it, it was of course for a jury, and not for a medical witness, to decide. If there was nothing more in the prisoner's favour than her own statement as to the time when she applied the ligature and her object in applying it, it is certain that a very humane interpretation was put on the facts. If the Court believed Casper's opinion to be correct, the woman should have been altogether acquitted, instead of having the punishment merely mitigated. It can be no crime, however absurd and unaccountable it may appear, for a person to place a ligature round the neck of a child after death, to give the appearance of strangulation. When such an extraordinary plea as this is raised, it is a fair matter of inquiry for a jury, to consider the motives of human conduct, and to judge of such a defence on the principles of common sense. If carried too far, no one who was not seen by others to perpetrate the act, could be convicted of homicidal strangulation. In the case of the *Queen* v. *Wren*, tried at the Winchester Lent Ass. 1840, the medical evidence went to show that the child had breathed, and was born alive. There was a piece of tape tied round its neck very tightly, and fastened behind, and there was a discoloration of the skin beneath. The tongue was livid and swollen, and blood was effused beneath the scalp. The medical witness admitted that the mark on the neck might have been produced after death: and as he could not positively say that the child had been destroyed by strangulation, the prisoner was acquitted. (See also the *Queen* v. *Hyland*, Cent. Crim. Court, Aug. 1844.) In *Reg.* v. *Green* (C. C. C. Feb. 1860), the body of the child was found with a riband round the neck, so tightly fixed that the parts around were swollen. Death was referred to strangulation, but it was suggested in the defence that the riband-ligature might have been placed there as an ornament or as part of the dress; and as the post-mortem examination of the body was not made until forty-eight hours after death, it was assumed that the tightening of the ligature was the result of a swelling of the body after death. The jury acquitted the prisoner.

Constriction before or after entire birth.—Judging from what has occurred on several recent trials, a medical witness must prepare himself for another and a more difficult question. Let us suppose it to be admitted, that the ligature was applied to the neck of a child while it was living, and after it had breathed; — it still remains to be determined, whether it was applied before or after the *legal* birth of the child, or, as some judges have laid down the rule, before or after an independent circulation has been established in the child's body. In the case of *R.* v. *Enoch*, it was held "that there must be an independent circulation in the child before it can be accounted alive." (Archbold, 367.) By an "independent circulation," we can only understand that condition in which respiration is established, and the blood no longer passes from the mother to the child. Thus, this state would be proved by a cessation of pulsation in the cord, and the crying or audible respiration of the child. It will be seen that this is tantamount to insisting upon absolute proof of respiration, as evidence of life; and, therefore, entirely conflicts with the opinions of other judges, who have held that proof of respiration is not necessary on a charge of murder, because a child might be born alive and not breathe for some time after its birth. (*R.* v. *Brain*, Archbold, 367.) On the other hand, if the presence of an independent circulation be the test of a child being legally alive at the time of the violence, the entire birth of its body is certainly not necessary for this; because, as it is well known, respiration may be established and consequently an independent circulation acquired, before the body of the child is *entirely born.* Here, again, this judgment is opposed to the opinions of those judges who have repeatedly held that, whether a child has breathed or not, entire live birth must be proved. One of the most common judicial objections to the hydrostatic test is, that a child may breathe, *i. e.* substantially acquire an independent circulation, but die *before its body is born.* In this state of uncertainty, it is difficult to say *what* medical evidence is required to prove. If an independent circulation alone is sufficient, it cannot be always necessary to prove entire live birth; but if proof of entire live birth be sufficient, then it cannot be always necessary to show that the child had acquired an independent circulation when the violence was offered to it! In a case of tenancy by courtesy (*Fish* v. *Palmer*, 1806, post, BIRTH), the judges of that time are reported to have held that the quivering or spasmodic motion of a lip after birth, without respiration, independent circulation, or any other sign of vitality, was sufficient to show that the child was born alive — and that it had thereby acquired civil rights which it could transmit to others, — its heirs. Why is the proof of an independent circulation in a child to be demanded of medical witnesses in a case involving a question of its murder, when, in respect to its acquisition of civil rights, such a proof is not called for? If the question were fairly considered by all the judges, probably proof of an independent circulation in this sense would not be required; at any rate it could not be consistently demanded, in the face of other decisions, that proof of respiration was not absolutely necessary to constitute live birth in law, even in cases of child-murder. Among cases in which this question has been raised one occurred on the Oxford Spring Circuit, 1841 (the *Queen* v. *Wright*). The child was found concealed in a garden; its throat was completely cut, and there was a stab under the left arm. Gurney B. is reported to have stopped the case because there was no proof that the child had had "an independent existence" when the wounds were inflicted. It is worthy of remark, that one form of murder may be the actual prevention of the establishment of an independent circulation or existence in the child, as where the navel-string is designedly tied before the commencement of the respiratory process. It has been suggested that ignorance of this point, among midwives, may be a cause of numerous still-births. In the meantime one fact is obvious, that whether the means of strangulation, if that be the form of murder, be applied to the neck of a living child before the entire birth of its body or afterwards, — before the establishment of an independent circulation (*i. e.* the act of respiration) or afterwards, — the appearances will be the same; and from these it will be impossible to say when the strangulation was accomplished.

Constriction before or after severance of the umbilical cord. — There is still another novel form which this question has taken. The witness may perhaps be asked whether the strangulation occurred before or after the umbilical cord was severed. It would appear that the severance of the cord has been sometimes regarded in law as a test of an independent circulation being established in the child: — but this is obviously an error, depending on the want of proper information respecting the phenomena which accompany birth. Respiration, and therefore an independent circulation, may exist *before* the cord is divided; and its severance, which is never likely to take place until after entire birth, cannot consequently be considered as a boundary between a child which is really born alive, and one which is born dead. A premature severance, as it was just now stated, might positively endanger the life of a child, instead of giving to it an independent existence. A healthy and vigorous child may continue to live and breathe independently of the mother, before the division of the cord, and the time at which the severance is made depends on mere accident. Hence the marks of strangulation on the neck of a living and breathing child must be the same, whether the cord be divided or not. The object of putting such a question is not apparent, unless it is intended to be implied that no child is legally born alive until the accoucheur or the woman herself chooses to sever the cord. It would therefore follow, on this doctrine, that to strangle a living child (entirely born) with the umbilical cord, provided this be not lacerated in the attempt, would not constitute infanticide! If this inference be incorrect, it is impossible to determine what can be the object of asking a medical witness such a question on these occasions. A case in which the cord was actually used as the means of destruction has been already given. (See ante, p. 511.)

The following cases will illustrate the difficulties which a witness may have to encounter when it is alleged that a child has been destroyed by strangulation. The first is that of *Rex.* v. *Crutchley* (Monmouth Lent Assizes, 1837). In this case the body of a child was discovered by a medical man (one of the witnesses) under the bed of the prisoner, who had been secretly delivered. There was a riband tied in a knot so tightly round its neck, as to have prevented respiration. The child had evidently been dead some hours, and the prisoner alleged that it was born dead. On inspection, the face was found swollen and the lips were livid: the lungs contained air, and were of a florid colour; they were crepitant and floated on water, so as to leave no doubt that the child had breathed. The vessels of the brain were gorged; the other viscera were perfectly healthy. He attributed death to strangulation;—he thought that the ligature had been placed round the neck before the umbilical cord, which had not been tied, was secured; but the reason for this opinion is not stated. He considered that the child had been born *wholly* alive, but admitted that the ligature would have produced the same appearance on the neck, had it been applied before the complete birth of the child. Another witness, however, stated that he thought the ligature might have been placed round the neck before the entire body of the child was born. The defence was, that the ligature had been used by the woman for the purpose of assisting herself in the labour; and that the medical evidence allowed, whether this was the motive or not, that it had been applied before the child was actually born. The judge desired the jury to consider, whether the prisoner wilfully killed the child;—if so, whether the killing occurred before or after the entire birth of its body,—and lastly, whether the killing took place while it was still attached to the body of its mother. Unless the child was destroyed after entire birth, the prisoner would be entitled to an acquittal:—if destroyed while still attached to the body of its mother, the point would be reserved for the consideration of the judges. The prisoner was acquitted. There can be no doubt that, provided a child be born entirely in a living state, the destruction of it would be murder, whether the cord were severed or not.

In the case of the *Queen* v. *Byron* (Chester Aut. Ass. 1838), the dead body of a child was found with a piece of rag tied round its neck, which in the opinion of the medical witness had caused death by strangulation; but on being questioned by the judge he admitted that the appearances might be explained by supposing that the prisoner had produced them in attempting to deliver herself. In the case of the *Queen* v. *Millgate* (Central Criminal Court, Nov 1842), the child was discovered dead. and on examination the face was livid, the tongue protruded, and the hands were clenched. Around the neck was a ligature which had been passed round four times, and was tied tightly. The vessels of the brain were congested, the lungs partially inflated, and the general appearance of the body was healthy. The medical witness thought that the child had been born alive, and had died from the effects of the ligature on the neck. The judge directed the jury that they must be satisfied that the child was completely born at the time the ligature was placed round the neck. The prisoner was acquitted. In another case, the *Queen* v. *Webster* (Worcester Lent Ass. 1839), the following facts were deposed to by the surgeon:—The child was full-grown and was born alive; this was inferred from the lungs being completely inflated. A ligature was found on the neck,—it had been passed round twice,—was very tight, and fastened in a knot: it had caused two deep indentations. The vessels of the scalp and brain were distended with blood, but there were no marks of external violence. Death was caused by strangulation. The judge left it to the jury to say, whether they were satisfied that the child was wholly born into the world alive; and if so, whether the prisoner had knowingly and wilfully destroyed it after it was born. The prisoner was acquitted.

Constriction without ecchymosis.—It may be an important question whether, in these instances, the absence of any mark or discoloration of the skin by the ligature should be taken as evidence of the means of constriction not having been applied during life. What we are entitled to say from observed facts is, that ecchymosis from the ligature is not a necessary consequence of constriction, either in a living or dead child:—although we might expect that there would be few cases of child-murder in which, when strangulation was resorted to, there would not be some ecchymosed mark or discoloration, chiefly on the presumption that great force is suddenly applied. Besides, it is not improbable that a slighter force would cause ecchymosis on the skin of a new-born infant than would be required to produce such an effect on that of the adult. When there is no mark from a ligature, an attempt may be made to show that death could not have been caused by strangulation, as in the following case (the *Queen* v. *Hagg*), which was tried at the Carlisle Summer Assizes in 1841:—The medical evidence was to this effect. The deceased child was discovered with a tape tied tightly round its neck. It was full-grown and healthy, and had been born alive, as respiration had been fully established. The lungs filled the chest, floated on water, and crepitated when pressed.

From the livid appearance of the face and neck, the congested state of the brain and an effusion of blood on the surface, combined with the ligature round the neck, the witnesses were of opinion that the child had died from strangulation. On cross-examination, they said that a child may breathe when partially born. The floating of the lungs in water is of itself an uncertain test, if the body is at all decomposed. With other tests it affords a proof of a child having been born alive. One witness said the ligature had produced no mark or discoloration on the neck, while others said it was perceptible. The inference is, that the mark could not have been very apparent, or there would have been no discrepancy on this point. It was ingeniously urged in the defence that the child could not have died from strangulation, because a tape tied so tightly round a child's neck as to cause death in this manner, would necessarily leave a discoloration of which no person could have any doubt. The prisoners were convicted. Had the defence been, as in the former cases, that there was no proof whether the ligature had been applied before or after entire birth, or the establishment of an independent existence in the child, the result might have been different. From the cross-examination it will be seen how certain stock-objections to the hydrostatic test are ingeniously made to affect medical evidence. An answer to a *general* question is rendered applicable to a *particular* case. A witness admits on a trial that the lungs may float from putrefaction or artificial inflation; in short, from other causes than respiration. If this answer be not qualified, an impression is immediately conveyed to the Court, and not always removed by a re-examination, that some of these causes may have given rise to the floating of the lungs in this particular instance,—when in fact there may not have been the least trace of putrefaction, nor the least ground for suspecting that artificial inflation had been practised. As contrasts to this case, see report of a case which occurred to Mr. Coales (G. H. Rep. 1842); and another by Dr. Scott (Ed. Med. and Surg. J. vol. 26, p. 62).

8. *Poisoning.*—This is placed among the probable means of perpetrating child-murder, but we rarely hear of *new-born* children being thus destroyed. The earliest age at which I have known a trial to take place for the murder of a child by poison, was two months. (*R.* v. *South*, Norf. Aut. Circ. 1834.) A quantity of arsenic was given to an infant, and it died in three hours and a quarter after the administration of the poison. At this age the case can scarcely be called one of infanticide, in its medico-legal signification; because all that it would be necessary to prove would be the cause of death,—the question of life or live birth would not require to be entered into. If, in a case of child-murder, death from poison should be suspected, it must be sought for in the usual way. Some cases

have occurred, in which children have been wilfully destroyed a week or two after birth, by the administration of opium or excessive doses of purgative medicine. Oil of vitriol has been also used.

Examination of the mother. — The duties of a medical practitioner, so far as they relate to the *mother* of the child, generally the accused party, are slight. He may be required to prove, by an examination made under an order from proper authority, whether she has or has not been recently delivered of a child, and to state the probable period at which the delivery took place. (See post, DELIVERY, p. 546.) This examination may be necessary in order to connect her delivery with the period which may have elapsed since the birth and death of the child. Unless the examination of a female be made within twelve or fifteen days, no satisfactory evidence of delivery can in general be obtained. It has happened, on more than one occasion, that medical men have assumed to themselves the right of enforcing an examination of a suspected female, and, by threats or otherwise, have compelled her to undergo this. Such a course of conduct is in the highest degree indecent and improper: — if a female willingly consent to an examination, or an order be obtained from a magistrate or other official person, the case is different. In taking this authority upon himself, a medical practitioner is forcibly compelling an accused party to produce positive proof of her guilt,—a principle which is entirely opposed to the spirit and practice of English jurisprudence.

Conclusions.—The following conclusions may be drawn from the preceding remarks:—

1. That congestion of the face and head, in a new-born child, is not a proof of death from strangulation.

2. That strangulation can only take place in children which have breathed.

3. That a child may be strangled during birth by the accidental twisting of the umbilical cord round its neck.

4. That the umbilical cord may produce a livid or ecchymosed depression on the neck, like any other ligature.

5. That marks on the neck, arising from accidental causes, may resemble those which arise from strangulation.

6. That the effect of constriction on the neck, either by the umbilical cord or any other ligature, is the same if the child be *living*, whether it has or has not breathed.

7. That the effect is the same whether the child has been *partially* or *entirely* born.

8. That the effect of a ligature on the neck of a *living* child is the same, whether the umbilical cord has or has not been severed.

9. That a new-born child may die from strangulation, without this fact being necessarily indicated by ecchymosis on the

neck. This depends on the nature of the ligature, and the amount of force used.

Summary. Frequent acquittals, in spite of medical evidence of criminality.—From the foregoing considerations it will be seen, that the two great points to be established by medical evidence, in a case of child-murder, are,—1st, that a child was *entirely born living* when the alleged violence was applied to it; and, 2nd, that its death was due *to that violence, and to no other cause whatever*. The leniency with which these cases are regarded by the law, and the extreme rigour with which the medical evidence of *live birth*, as well as of the *cause of death*, is treated, must show that they who consider that the use of the hydrostatic test can ever lead to the conviction of an innocent woman, have taken a very limited and incorrect view of the subject. The question of murder rests here, as in all other cases, upon clear and undoubted proof of the cause of death; and more than this, it must be shown that the violence was *criminal*, and not by any possibility accidental. Then it should be proved that this violence, if criminal, had been applied to the body of a child at a particular period—*i.e.* after entire birth; a case which, from what has been already stated, can rarely admit of clear medical proof. If strangulation, for example, be rendered probable from the facts, the woman cannot be convicted unless proof be afforded, 1st, that the child was strangled after its entire body was born;—and 2nd, that she could not possibly have produced the marks of strangulation in her convulsive or half-conscious attempts at self-delivery. Medical evidence can rarely be in a condition to establish either of these points, and the assumptions will therefore be, as in the numerous cases already reported, in favour of a prisoner. A serious question will probably here suggest itself, from the number of *impossible* medical proofs, so to term them, which the law requires in these cases, namely—How can a conviction for child-murder ever take place when there are no eye-witnesses to the crime? The answer is, that these difficulties may not be raised in the prisoner's favour; but this of course is a matter of accident. On most charges of infanticide, if the counsel for the defence insisted upon distinct medical proof of the child having been *entirely born alive*, when the violence was offered to it; or that respiration, if clearly established by evidence, took place, not during labour, but after complete birth, or after the child had acquired an independent circulation;—neither of these proofs can be possibly afforded, and the case, so far as medical evidence was concerned, would fall to the ground. That this is not an exaggerated view of the subject, will be evident from a case tried at the Lancaster Lent Assizes, 1846 (*Reg.* v. *Hacking*). A female servant was charged with the murder of her infant child. The evidence went to prove that she had attempted to conceal her pregnancy. It was ascertained that she had been delivered of a child, and the medical evidence was to the effect, that its throat had been cut by some thin-bladed sharp instrument—*a portion of the gullet and wind-pipe having been cut away.* The prisoner stated that the child was born dead, and confessed that she had, as she believed, cut its throat with a pen-knife, which she had afterwards wiped and put away. The weapon was found in her pocket. The medical witness deposed that the child had certainly *breathed,* and he was inclined to think that it had been *born alive.* He admitted that a child may breathe when partially born, and die before it was wholly born; also, that the appearance of the wound, whether inflicted before or immediately after death, would be very similar; and it was impossible, from the examination of it, to say whether the child had been partially or wholly born at the time of its infliction. The counsel for the prisoner contended that no evidence had been adduced which could satisfy the jury that the child had been *fully born alive;*—a circumstance without which the charge must fall to the ground. The jury acquitted the prisoner of the murder. (Med. Gaz. vol. 37, p. 382.) In examining this case, it may be observed, that such a wound with a pen-knife was hardly likely to have been inflicted on the child by any accident, or for the purpose of aiding its expulsion during delivery. As the child had breathed, it is absurd to suppose that the woman waited until it had died from some other cause, of which there was no appearance; and that after death, without any conceivable motive, she cut out a portion of its throat. So far as the report goes, the acquittal appears to have depended on the allegation that the child was destroyed before it was wholly born: and although it had breathed, there was a want of evidence to show that this breathing had continued after it was entirely in the world. (See also another case in the same vol. p. 1007: and Prov. Med. Journ. April 2, 1851, p. 182.)

The frequent acquittals which take place on charges of child-murder, in spite of strong evidence of criminality, most probably depend on the fact, that there are many extenuating circumstances in a prisoner's favour. She may be young, unfortunate, friendless, and perhaps tempted by a seducer, or by utter destitution, to the perpetration of the crime. According to the present state of our law, the jury have no alternative but to convict her of a capital offence, or acquit her of the charge of murder, and find her guilty of the concealment of birth, the extreme punishment for which is two years' imprisonment. This is substantially the punishment at present inflicted for the crime of infanticide in this country: for it is not to be concealed that, *medically* speaking, these technical points relative to "live birth," to "entire birth," or to an "independent circulation in the child," or lastly, "concealed birth," are only so many ingenious legal means for evading convictions on a capital charge. Whatever doubt may exist according to the forms and principles of law, there can be no doubt, medically, that living children are often criminally destroyed, and that the law, from the peculiar nature of the proof required, as well as from the severity of the punishment attached in all cases to the crime, cannot reach the perpetrators. In many of these cases the punishment of death would be as much too severe, as the punishment of two years' imprisonment for "concealed birth" is too slight; and with a full contemplation of this difficulty, the Civil Code of France (Art. 319) wisely permits the Court, on proof of extenuating circumstances, to mitigate the punishment. Some such provision is required in our law; and the unnecessary perplexities which are now thrown on medical evidence, as well as the conflicting opinions on what is live birth and what is not, would then disappear. A change of this kind might undoubtedly be made, without prejudice to the accused, or interference with the course of justice. A writer in the Legal Examiner (Sept. 11, 1852, p. 555) has suggested that a special Act of Parliament should be passed to render proof of "entire birth" unnecessary, and that there should be at the same time some mitigation of the punishment. A modification of this kind appears to be necessary, unless we are prepared to admit that the destruction of a living and breathing child *during* the act of birth is not a crime.

It is a question which it would be here out of place to discuss, whether a verdict of manslaughter might not be proper on many of these occasions; for to say that the whole offence consists in concealing the birth of a still-born child, is virtually to disbelieve and reject the clear and satisfactory medical evidence often adduced. A verdict of manslaughter would not, however, cover those numerous cases in which it is *assumed* that the child had only lived to respire during the act of birth, and not afterwards; and yet in a recent case (*Reg.* v. *Tommey*, Warwick Lent Assizes, 1854), tried before Coleridge J., in which a medical witness declined to say positively that a child was born alive and had breathed after birth, the jury convicted the prisoner of manslaughter. Respiration had been established, but it was admitted by the witness that this might have occurred during birth. There was a cut on the right side of the neck of the child, and a circular wound in the wind-pipe. The jury considered, notwithstanding the medical doubt, that the child had really come into the world alive. At the same time, they appear to have thought that the wounds on the neck were caused during attempts at self-delivery, and had not been inflicted with the intention of murdering the child. Dr. Christison, in commenting upon the frequent acquittals on the capital charge, and convictions only on a minor offence, which cannot always be proved, attributes it to a feeling sometimes entertained in the present day, that the killing of a new-born child, when perpetrated under the impulse of injured honour and the fear of disgrace, should not be classed with the other varieties of murder. (See Ed. M. and S. J. vol. 26, p. 76.) There can, I think, be no doubt that this is the true explanation. (See case by Mr. Coales, Guy's Hospital Reports, April 1842.)

It may be mentioned, in concluding this subject, as the point has given rise to a trial for malapraxis, that if injuries should be criminally inflicted on a child during birth, and the child be born alive and afterwards die from the injuries so caused, the case would be murder or manslaughter, according to the circumstances. The following instance is reported by Chitty (Med. Jour. 416; also Archbold, 345): — A man of the name of *Senior*, who, it appears, was an unlicensed medical practitioner, was tried, in 1832, for the manslaughter of an infant, by injuries inflicted on it at its birth. The prisoner practised midwifery, and was called to attend the prosecutrix, who was taken in labour. The evidence showed, that when the head of the child presented, the prisoner, by some mismanagement, fractured, and otherwise so injured the cranium, that it died immediately *after* it was born. It was argued in defence, that as the child was not born (*in ventre sa mère*) at the time the wounds and injuries were inflicted, the prisoner could not be guilty of manslaughter. The judge, however, held that as the child was born *alive* and had died, the case might be one of manslaughter. This opinion was afterwards confirmed by the other judges, and the prisoner was convicted and sentenced to imprisonment. From the decision in this case, it will be seen that the law makes the question of criminality to depend upon the period at which the injuries prove *fatal*, and not upon the time at which they are inflicted on the body of a child. The decision appears to depend on this principle of the criminal law, that the person killed must be a reasonable creature in being, and under the king's peace: — therefore to kill a child in its mother's womb (or during birth) is no murder. (Archbold, 345.) The child, unless entirely born alive, does not come under the description above given. It is under these circumstances *medically* but not *legally* a *living* child. Admitting the wisdom of adopting some fixed rule of this kind in a legal view, it is undoubtedly proper that the lives of children *during the act of birth* should be protected: — at any rate, that their destruction should not be treated, as it now appears to be, with perfect impunity.

If a child be born alive, as a result of criminal abortion, and die, not from any violence applied to its body, but as an effect of its being immature, this will be sufficient to render the party causing the abortion indictable for murder.

It is difficult to determine the number of cases of infanticide which take place annually in this country; but in France, where criminal statistics are more closely attended to, there were, in 1838, one hundred and twenty-nine cases; and in 1841, one hundred and forty-seven cases. (See Annales d'Hygiène, Oct. 1840.)

PREGNANCY.

CHAPTER 48.

PREGNANCY IN ITS LEGAL RELATIONS—SIGNS OF PREGNANCY—SUPPRESSION OF THE MENSES—PROMINENCE OF THE ABDOMEN—CHANGES IN THE BREASTS—QUICKENING—UNCERTAINTY OF THE PERIOD AT WHICH IT OCCURS—SOUNDS OF THE FŒTAL HEART—KIESTEIN IN THE URINE—CHANGES IN THE MOUTH AND NECK OF THE UTERUS—FEIGNED PREGNANCY—DE VENTRE INSPICIENDO—PLEA OF PREGNANCY IN BAR OF EXECUTION—THE JURY OF MATRONS—CONCEALMENT OF PREGNANCY—PREGNANCY IN THE DEAD—PREGNANCY IN A STATE OF UNCONSCIOUSNESS.

Pregnancy. Legal relations.—The subject of pregnancy, in so far as the proofs of this condition in the *living* female are concerned, rarely demands the attention of a medical jurist. If we except the few instances in which a magistrate requires an opinion from a medical man respecting the pregnancy of a pauper female brought before him, there are only two cases in the *English* law in which pregnancy requires to be verified; and these so seldom present themselves, that the questions connected with the pregnant state rather belong to the science than the practice of medical jurisprudence.

SIGNS OF PREGNANCY.

Suppression of the menses.—It is well known that in the greater number of healthy females, so soon as conception has taken place, this secretion is arrested. But there are certain abnormal conditions which must not be overlooked. There are some cases recorded which show that women, in whom the menses have never appeared, may become pregnant. This, however, is allowed by all accoucheurs to be rare; and when it occurs, which we may readily learn from the account of the female, it will be necessary to search for other signs in order to determine the question of pregnancy. Irregularity as to the period at which the function takes place, is common among females. This irregularity may depend either upon the age of the person, or upon disease, either of which causes it will not be difficult to recognize. Their continuance after conception may make a pregnancy appear short. A case is reported in which a woman was married in the summer of 1856, and the menses continued after as before marriage. In October 1857, they ceased for the first time, and in the following December, the female was delivered of a full-grown child. The abdomen was not much enlarged, and the woman thought that she was only two months pregnant. (Med. Times and Gaz. April 30, 1859.) It is well known that there are numerous disorders of the uterus under which, irrespective of pregnancy, the menses may become suppressed. The continuance of the menstrual discharge when once set up is not a necessary condition for impregnation. Dr. Murphy has reported the case of a woman who for sixteen years went on bearing children, eight in number, without having had during that period any appearance of the menses. The late Dr. Reid, who quotes this case, mentions five instances that fell within his own knowledge in which females became pregnant notwithstanding a long previous cessation of the discharge. (Lancet, Sept. 10, 1853, p. 236.) The absence of the menses as a consequence of pregnancy is generally indicated by the good health which a female enjoys: —and, although disease may coincide with pregnancy, yet a careful practitioner will be able to estimate from the symptoms to which cause the suppression is due. On the other hand, a discharge perfectly analogous to the menstrual, sometimes manifests itself, not merely for several periods in a pregnant woman, but during the whole course of pregnancy. (Dr. Murphy's Obstetric Report, 1844, p. 9; also Henke, Zeitschrift der S. A. 1844, 265.) Mr. Whitehead has collected seven well-marked instances of menstruation during pregnancy. (On Abortion, 218.) These facts show that we must be cautious in our opinion; and not declare that, because a discharge continues, pregnancy cannot possibly exist, or, because it is suppressed, a female must be pregnant.

Feigned menstruation.—The menses may be really suppressed; but if there be any strong motive for the concealment of her condition, a female may feign menstruation. Dr. Montgomery detected a case of this kind, by the examination of the areolæ of the breasts. The woman had stained her linen with blood, in order to make it appear that the menses continued; but she subsequently admitted that this was an imposition. It has been stated that there are differences between menstrual and ordinary blood, but there are no certain chemical means of distinguishing them. (See ante, p. 302.)

Prominence of the abdomen.—A gradual and progressive enlargement of the abdomen is a well-marked character of pregnancy. The skin becomes stretched, and the navel almost obliterated. The enlargement in general begins to be obvious about the third month, although there are some females of peculiar organization, in whom the enlargement may not become perceptible until the fifth or sixth month, or even later: still it may be detected on examination. In fact, this sign can never be absent in pregnancy, although it may not be so apparent in some females as it is in others. The objection which exists to it is, that numerous morbid causes may give rise to prominence of the abdomen. This is undoubtedly the fact,—as we have occasion to witness in the various kinds of dropsy, or in suppressed menstruation,—diseases which, in several instances, have been mistaken for pregnancy by eminent practitioners. On the other hand, instances are not wanting, in which, owing to the persistence of menstruation, and the absence of quickening, the gravid uterus has been actually tapped, by mistake, for an ovarian tumour: the operation being speedily followed by the birth of a full-grown child! (Whitehead on Abortion, p. 186); but the history of a case will in general enable a practitioner to form an opinion. A case of suppressed menstruation strongly simulating pregnancy, is reported by Dr. Rüttel. (Henke, Zeitschrift, 1844, 240.) The enlargement may be owing to disease, 1, when it has been observed by a female for a time longer than the whole period of gestation; 2, when it has been accompanied by a generally-diseased condition of the system; and, 3, when there is an absence of the other symptoms of pregnancy. The most embarrassing cases are unquestionably those in which abdominal disease coexists with pregnancy. Here time alone can solve the question, and a medical jurist should give the benefit of his doubt to the side of chastity, mercy, and humanity. (On an important case in which an abdominal tumour was mistaken for pregnancy, see Lancet, Oct. 16, 1847, p. 408.) While the abdomen enlarges from pregnancy, the margins of the abdominal muscles become more clearly defined. The navel is less depressed, and gradually acquires the level of the surrounding skin. As pregnancy advances, it becomes more prominent, and in the last month it assumes the character of a tumour, instead of a depression. (Whitehead, loc. cit. 209.)

A change in the breasts.—These organs in a pregnant female are full and prominent, and the areolæ around the nipples undergo changes which Dr. Montgomery and others regard as highly characteristic of the pregnant state. A mere fulness or pain in the breasts, and even in some rare instances the secretion of milk, may arise from other causes than pregnancy. Severe uterine or ovarian irritation may cause the breasts to become painful and swollen. The fulness of the breasts from pregnancy is not commonly observable until about the second or third month; and with regard to the secretion of milk, in non-pregnant females, the few rare cases of its occurrence on record show that it takes place under circumstances which cannot well be mistaken for the pregnant condition. (See Henke, Zeitschrift der S. A. 1844, 269.) The *areola* is generally observed, during pregnancy, to become considerably darker in colour, and larger in diameter. The skin of which the areola is formed becomes soft, moist, and slightly tumid. The little glandular follicles about it are prominent, and often bedewed with a secretion; the change of *colour* has been the most attended to. The areolæ are commonly well marked in from the second to the fourth month of pregnancy: the intensity of colour being the last condition of the areola to appear. The prominence of the glandular follicles does not always exist in pregnancy, and the areola may become large and dark-coloured from other causes: consequently these signs are only to be looked upon as corroborative. In females of dark complexion, the areolæ are dark, irrespective of pregnancy; and in some cases of advanced pregnancy these changes in the areolæ are entirely absent. (Edin. Month. Jour. March 1848, 693.) Dr. Montgomery has described as a sign of pregnancy, the existence of a *brown line* extending from the pubes to the umbilicus, especially in females of dark complexion, and a dark-coloured but not raised areola of about a quarter of an inch in breadth, around the navel.

Quickening. — The signs above given are applicable to the early as well as to the late stages of utero-gestation: but that which we have here to consider is one which is rarely manifested until about the fourth or fifth month. Quickening is the name applied to peculiar sensations experienced by a female about this stage of pregnancy. The symptoms are popularly ascribed to the first perception of the movements of the fœtus, which occur when the uterus begins to rise out of the pelvis: and to these movements, as well as probably to a change of position in the uterus, the sensation is perhaps really due. The movements of the fœtus are perceptible to the mother before they are made evident by an external examination. The term is derived from the old Saxon word "quick," signifying living, as, at the time when medicine was in its infancy, it was considered that the fœtus only received vitality when the mother experienced the sensations of its motion! On the occurrence of quickening, there is generally a great disturbance of the system: indicated by syncope, nausea, and other distressing symptoms. After a short time the female recovers: and if sickness has hitherto attended the pregnant state, it has been frequently observed to disappear when the period of quickening has passed.

No evidence but that of the female can satisfactorily establish the fact of quickening, and this it is necessary to bear in mind; since, in some cases in which pregnancy is an object of medico-legal importance, proof of quickening may be demanded by the law. Dr. Reid remarks (Lancet, Sept. 10, 1853, p. 237) with respect to this sign, that few women can tell the exact day on which they first feel it; and a large proportion cannot place it within a range of fourteen days, which is of little assistance in the calculation of the probable date of delivery. Women who profess to be most exact in noting the period of quickening, differ from each other as to the time. There is much self-deception as to this symptom. The discovery of the movements of a child by an examiner is really a proof that the usual period of quickening is past, but their non-discovery, at the time of examination, is no proof whatever that the woman has not quickened: since the movements are by no means constant, and may be accidentally suspended even at several successive examinations. Besides, cases every now and then occur, in which well-formed, healthy females do not experience the sensation of quickening during the whole course of pregnancy; and what is of more importance, the movements of the child may be at no time perceptible to the examiner. The uncertainty of quickening, as a sign of pregnancy, is too well known to require more than adverting to. Females have been known to mistake other sensations for it, and in the end it has been proved that they were not pregnant. A woman may declare that she has felt quickening when she has not: and unless the movements of the child be perceived by the examiner at the time, how is he to confirm or disprove her statement? Quickening. then (so far as it concerns the statement of the female), cannot be relied on as a proof of pregnancy; but if the movements of the child can be felt by the examiner through the abdomen, this is clear evidence, not only of the woman being pregnant, but of her having passed the period of quickening.

We may next consider the *period* of pregnancy at which this symptom ordinarily occurs. Our law seems to infer, that it is a constant, uniform, and well-marked distinction of the pregnant state; and in some instances it insists upon proof accordingly. Taking the general experience of accoucheurs, quickening happens from the tenth to the twenty-fifth week of pregnancy; but the greater number of instances occur between the *twelfth* and *sixteenth* week; — or between the fourteenth and eighteenth week after the last menstruation. The late Dr. Reid considered it to denote about the sixteenth, seventeenth, or eighteenth week of pregnancy. The date corresponds to the termination of the fourth calendar month. One of his patients did not feel this symptom until the seventh calendar month (Lancet, September 10, 1853). It is a popular opinion that quickening takes place exactly at the end of four calendar months and a half: but it mostly occurs two or three weeks earlier than this period. Many females estimate that they are four months advanced in pregnancy when they quicken: but this mode of calculation is open to numerous fallacies. Dr. Rodrique knew a lady who invariably quickened at two months, and went full seven months after, with all her children, — five in number. (Amer. Jour. Med. Sci. Oct. 1845, p. 339.)

From these observations, it will be seen that an examiner may sometimes detect the *movements of the child* about the third or fourth month, — at others not until the fifth or sixth; — and in other instances not at all, throughout pregnancy. Even in those cases in which the movements of the child have indisputably existed, they are not always to be perceived: hence several examinations should be resorted to, before any opinion can be fairly expressed from their absence. In making these examinations, the diagnosis is often facilitated by previously immersing the hand in cold water, and then suddenly applying it to the abdomen. When the movements of the child are distinctly perceived through the parietes of the abdomen, they constitute a certain sign of pregnancy; but their non-discovery at a particular time is no proof that a female is not pregnant. The jury of matrons probably trust to this sign: hence their verdicts commonly turn out to be erroneous. There is another source of fallacy which may present itself when an artful woman is desirous of making it appear that she is pregnant, — namely, that a woman may simulate the movements of a child by a peculiar action of the abdominal muscles. Medical practitioners of repute have been deceived for a time by this artifice: but this occurred before the discovery of chloroform or the stethoscope.

Sounds of the fœtal heart.—Another sign is that which is derived from *auscultation.* By the application of the ear or a stethoscope to the abdomen, at or about the fifth month of pregnancy, rarely earlier, the pulsations of the fœtal heart may be recognized and counted. These pulsations are not synchronous with those in the arteries of the mother: they are much more rapid, and thus it is impossible to mistake them. Their frequency, according to Dr. Hope, is in an inverse ratio to the stage of gestation, being 160 at the fifth, and 120 at the ninth month. This sign, when present (like the movements of the child), not only establishes the fact of pregnancy beyond all dispute, but shows that the child is living. The sound of the fœtal heart is, however, not always perceptible: when the child is dead, of course it will not be met with: but its absence is no proof of the death of the child, because the hearing of the pulsations by an examiner will depend very much upon the position of the body, the quantity of liquor amnii, and other circumstances. Thus it may be distinctly heard at one time, and not at another; it may be absent for a week or fortnight, and then will reappear: so that, although its presence affords the strongest affirmative evidence, its absence furnishes uncertain negative evidence; and several examinations should be made, in the latter case, before an opinion is formed. The earliest time at which the pulsations may be heard has been stated to be about the fifth month; but they will be best heard between the sixth and eighth. The reason why the sound is not always perceived is owing, not only to changes in the position of the child, but to the vibrations having to traverse the liquor amnii and the soft parietes of the abdomen. The point of the abdomen where the sound can be best heard is in the centre of a line drawn from the umbilicus to the anterior inferior spinous process of the ilium on either side,—perhaps most commonly on the right. When clearly detected, it is an unequivocal sign of the pregnant state. Besides the sound of the fœtal heart, auscultation has led to the discovery of what is called the placental murmur. This sound is more likely to create fallacy than that of the fœtal heart. (See a paper on this subject by Dr. Druitt, Med. Times and Gaz. Jan. 21, 1860.)

Kiestein in the urine.—A substance called *Kiestein* has been found in the urine of pregnant females. It appears as a fatty iridescent pellicle on the surface of the urine about twenty-four hours after it has been voided. There are various opinions concerning the nature of this substance, some regarding it as a mixture of casein and oil with earthy phosphates (Dr. Bird, G. H. Rep. April 1840, p. 26), and others as a modification of albumen (L'Héritier, Chimie Pathologique, p. 483). From the researches of Dr. Möller, its presence in the urine is subject to so much uncertainty, that it is wholly unfitted to serve in medical jurisprudence as a diagnostic character of pregnancy (Casper's Wochenschrift, vol. 2, 1845, s. 21). Dr. Mickschick has arrived at similar conclusions (Med. Gaz. vol. 39, p. 264). Mr. Kane obtained kiestein in equally great quantity from the urine of a virgin aged fourteen, and that of a woman who had nursed for two months. (Whitehead on Abortion, p. 231.) Dr. Golding, however, entertains a high opinion of its value as a sign of pregnancy in its earlier stages, when the other signs are obscure. According to this gentleman, it is present in the urine at all periods of pregnancy;—it is identical with milk in a crude form, and is to be regarded as a secretion of the mammary glands (Obstetric Record, vol. 2, p. 45). Dr. Rees has detected in it milk-globules, and considers it to be caseous matter altered by passing through the kidney (Anal. of Blood and Urine, p. 217).

In reference to the above signs it may be observed, that if the motions of the child or sounds of the heart be perceptible, no other evidence of pregnancy need be sought for. The mere suppression of the menses, prominence of the abdomen, and fulness of the breasts, cannot alone establish the fact; but, unless the morbid causes of these abnormal states of the system be clearly and satisfactorily obvious to the examiner, it is a fair presumption that the female is pregnant. In any case in which a doubt exists, we should require sufficient time for a clear opinion.

Changes in the mouth and neck of the uterus.—The signs hitherto mentioned are chiefly relied on in medical practice; but it must be remembered that no case can possibly occur in civil or criminal jurisprudence in which it will not be in the power of a medical witness to make an examination of a female. He may then form a safe judgment from the changes which take place in the neck of the uterus, and from the sensation imparted to the finger by the presence of a rounded body (like the fœtus) floating in a liquid, when an impulse is given to the uterus from below. Up to the fifth or sixth month of pregnancy, the neck of the uterus may be commonly felt projecting into the vagina; it is of its usual length, hard and firm. After that period, the uterus rises into the pelvis, and the neck is spread out, shorter and softer, the aperture increasing in size and becoming rounder. Towards the end of gestation, the neck of the uterus appears to be lost, becoming like a thin membrane, and sometimes no aperture can be felt.

A well-marked test of pregnancy is the motion perceptible to the finger on giving a sudden impulse to the neck of the uterus. Capuron calls this the touchstone in the distinction of the pregnant state:—without it, he considers a medical jurist may be easily deceived. To this passive motion of a child, the name of *ballottement* is given. It cannot be easily determined before the fifth or sixth month; but after the latter period, especially as pregnancy becomes advanced, it is always available. In the French schools, the method of applying the *toucher* and *ballottement* to pregnant females is systematically taught, and by a little practice it may be easily acquired.

As most of these signs refer to an advanced stage, a witness may be asked, what are the unequivocal indications of pregnancy *before the fifth and sixth month?* The answer to this question is of little moment to a medical jurist, since he is rarely required to give an opinion under these circumstances. In all *legal* cases, when pregnancy is alleged or suspected, it is the practice for a judge or magistrate, on a representation being made by a medical witness, to postpone the decision one, two, or three months, according to the time required for obtaining *certain evidence*. The evidence will consist in plainly distinguishing a rounded body floating freely in the uterus,—the movements of a fœtus,—and the sounds of the fœtal heart. The most experienced men agree, that before the *sixth month* the changes in the cervix and os uteri are of themselves too uncertain to enable an examiner to form a safe opinion; and *à fortiori* it is impossible to trust to external signs. Mr. Whitehead dissents from this view, and considers that a specular examination of the mouth of the uterus is not only more satisfactory than any other mode of exploration, but that it will enable a person to determine with certainty the existence of pregnancy during its earlier stages,—from a few days after conception to the middle or end of the fourth month, when auscultation first becomes available. In the *fourth week* the labia of the mouth of the uterus at the centre of their margins are permanently separated to the extent of one or two lines; and the os tineæ (the aperture) itself, which was before a mere chink with parallel boundaries, forms an elliptical, or sometimes rounded aperture, which is occupied by a deposit of transparent, gelatinous mucus. At *six* or *eight* weeks it is decidedly oval or irregularly circular, with a puckered or indented boundary having a relaxed and lobulated character. The whole circumference of the neck is enlarged, and the commissures or angles of the os tineæ are obliterated. The os continues of this irregular form throughout the whole period of gestation; but from the time of quickening to the end of the seventh month the progressive changes are not so marked as to form a guide for determining the period of pregnancy. (On Abortion, p. 204.) This condition of the mouth of the uterus must not be confounded with its menstrual state in the early stages, nor with a diseased state in the latter stage of gestation.

Feigned pregnancy.—Pregnancy is sometimes feigned or simulated for the purpose of extorting charity, of obtaining a settlement in a parish, or of compelling marriage; but it is scarcely necessary to observe that an impostor may be easily detected by a well-informed practitioner, since a woman always feigns an advanced state of pregnancy. Although she may state that she has some of the symptoms depending upon pregnancy (and, unless she has already borne children, she will not be able to sustain a cross-examination even respecting these), yet it is not possible for her to simulate without detection a distension of the abdomen or the state of the breasts. If she submits to an examination, the imposition must be detected: if she refuses, the inference will be that she is an impostor. Females have been known to possess the power of giving apparent prominence to the abdomen, and even of simulating the movements of the child by the aid of the abdominal muscles (*ante*, p. 532). By placing them under the influence of chloroform, the abdomen at once collapses, and the imposture is detected. These cases of spurious pregnancy are sometimes met with in hysteric females. (See case by Dr. Simpson, Ed. Month. Journ. 1854, vol. 9, p. 473. See also Lancet, April 14, 1855, p. 381; April 28, 1855, p. 429; and May 26, 1855, p. 533.) Pregnancy may be feigned by a female in order to avoid being sent by a magistrate's order to a distant parish, or to escape the punishment of hard labour, to which she may have been sentenced. If in the latter case the slightest doubt should exist whether the female be really pregnant or not, an affirmative opinion should be given, at least for a time, since great and even irreparable mischief might result by taking an opposite course.

In civil cases of feigned pregnancy, an examination should always be insisted on, or the reputation of a practitioner may suffer by his giving a hasty opinion on the subject. In this respect the case of *Devonald* v. *Hope*, Q. B. December 1838, is of some interest. A medical man having given an opinion that a female patient was pregnant, subsequently brought an action against her for medical attendance. It turned out, however, that she was not pregnant, and that there were no satisfactory medical grounds upon which his opinion was based. The plaintiff complained of having been deceived by the female as to her condition; but it is obviously in the power of every medical man to prevent such a deception being practised on him. An external examination only will not suffice either to affirm or negative the allegation of pregnancy, except when it is stated to be far advanced. For a singular case in which, on a charge of assault, evidence of this kind was tendered, see Med. Gaz. vol. 36, pp. 1083, 1169. (On the fallacy of the signs of pregnancy, and the simulation of this state, see a paper by M. Tardieu, Ann. d'Hyg. 1845, vol. 2, p. 429; also 1846, vol. 1, p. 83.)

De ventre inspiciendo.—One of the cases in the English law, in which pregnancy requires to be verified, is of a civil nature. It is in relation to the Chancery writ "*de ventre inspiciendo.*" A woman may assert that she is pregnant at the time of her husband's death, and the heir-at-law may sue out a writ to require some proof of her alleged pregnancy, as his right to the estate of which the husband died possessed, may be materially affected by the result. Until within a recent period, the decision of the question of pregnancy was left to twelve matrons and twelve respectable men, according to the strict terms of the ancient writ; but in some late cases, it has been considered advisable to depart from this absurd custom, and to place the decision in the hands of medical practitioners.

In May 1835, a gentleman named *Fox* died, leaving a widow, to whom he had not been married more than six weeks. By his will, made some months before his death, he left the great bulk of his property to the use of Ann Bakewell, spinster, for the term of her natural life, so long as she remained sole and unmarried; and after her decease or marriage, to one John Marston. Soon after the making of the will, this Ann Bakewell became the wife, and subsequently the widow of Mr. Fox. Notwithstanding that she had married the testator himself, the plaintiff Marston claimed the property of the widow, on the ground of her having infringed the terms of the will by her marriage with the testator! She pleaded pregnancy, and in August 1835, the writ "*de ventre inspiciendo*" was sued out of Chancery by Marston. Some discussion took place in Court on the question whether the writ should be issued in its original indelicate form or not: *i. e.* whether the female should undergo examination by the sheriff, assisted by twelve matrons and twelve respectable men! The widow petitioned the Court not to issue the writ; and put in an affidavit from her ordinary medical attendant, to the effect that she was pregnant and too weak to undergo the proposed examination. Ultimately it was decided that two matrons, with a medical man on each side, should visit Mrs. Fox once a fortnight until her delivery. There was no doubt of her pregnancy, and she was delivered at the due time, to the great disappointment of the residuary legatee. (See Med. Gaz. vol. 16, p. 697; vol. 17, p. 191.) The nature of this judicial examination will be understood by quoting the terms of the writ addressed to the sheriff. "In propriâ personâ tuâ accedas ad præfatam R et eam coram præfatis videri et diligenter examinari et tractari facias per ubera et ventrem omnibus modis quibus melius certiorari poteris utrum impregnata sit necne." (*Register Brevium.*) There can of course be no difficulty in forming an opinion in such a case, provided the pregnancy be at all advanced. It is, however, not a little singular, that in the present day any attempt should be made to apply the feudal customs of a rude and barbarous age, to the determination of questions which belong exclusively to an advanced state of medical science.

Plea of pregnancy in bar of execution.—The second case in which pregnancy requires to be verified in English law, is in relation to criminal jurisprudence. When a woman is capitally convicted, she may plead pregnancy in bar of execution. The judge will then direct a jury of twelve married women, "*de circumstantibus*," to be empannelled, and sworn to try, in the words of the law, "whether the prisoner be with child of a quick child or not." If they find her quick with child, she is respited: otherwise the sentence will take effect. In admitting the humanity of the principle by which a pregnant woman is respited until after her delivery, there are two serious objections to the practice of the common law, whereby it is made to fall short of what, in a civilized country, society has a right to expect from it: these are, 1, that the question of pregnancy is allowed to be determined by a jury of ignorant women accidentally present in Court; and 2, that the respite is made to depend, not upon proof of pregnancy, but upon the fact of a woman having quickened! This sign of the pregnant state has been known to occur so early as the third, and so late as the sixth month: some females have even reached the seventh month without observing it: hence, the infliction of capital punishment, under these circumstances, would be a matter of accident (*ante*, p. 530). Quickening is a sign not easily established, except by extorting a confession from the female; and this is the only possible way in which, in a doubtful case, the question could be determined by a jury of matrons. They commonly trust to feeling externally the motions of a child, but this is at all times a purely accidental circumstance, and they may not be perceptible at the time of the examination. It must be obvious, on the least reflection, that the means resorted to by the English law to determine such a question are bad, and are quite unfitted for the present state of society. Several modern cases show that a jury of matrons may be easily deceived with respect to this sign of pregnancy. In *Rex* v. *Wright*, the prisoner was found guilty of the murder of her husband by poison. She pleaded pregnancy in bar of execution. The judge empannelled a jury of matrons; and they, after a form of examination had been gone through, brought in a verdict of *not quick* with child. The woman would have been executed, had not several medical practitioners of Norwich represented to the judge that the method taken to determine pregnancy and quickening was so unsatisfactory that no reliance could be placed upon it. The prisoner was then examined by some medical men, and was found to have passed the usual period of quickening! The judge respited the prisoner, and the correctness of the medical opinion was confirmed by the female being delivered, within four months afterwards, of a healthy full-grown child. (See Med. Gaz. vol. 12, p. 22; *Rex* v. *Wright*, Norwich Lent Assizes, 1832.) In a case tried in March, 1838, a woman was convicted of murder, and pleaded pregnancy. A *medical* opinion was here required. The pregnancy, if it existed, had so little advanced, that the practitioner was unable to give a satisfactory report: and the judge respited the prisoner for a month, in order that the witness might have full opportunity to ascertain the fact. Still the jury of matrons is occasionally resorted to. Thus in the case of *Reg.* v. *Westwood* (Stafford Winter Assizes, 1843), the matrons were summoned to examine a female capitally convicted, and they negatived the plea! It is not a little remarkable that, although in so many cases the matrons have given a wrong verdict, and that in no instance can they give a right one except as a matter of pure conjecture, the practice still continues. Thus this antiquated practice was revived at the Central Criminal Court in 1847. (*Reg.* v. *Hunt*, September 1847.) This woman was convicted of murder: she pleaded pregnancy, and the matrons were empannelled and directed to use "their best skill" to determine whether the prisoner "was big with a quick child or not." It was left to their option to have the assistance of a surgeon. In half an hour they returned a verdict "that she had not a living child within her." The law was directed to take its course; and the woman would have been executed, but for the interference of the Secretary of State. He directed that the prisoner should be examined by competent medical men, who ascertained that she was really pregnant, and had passed that stage at which quickening is most commonly perceived. She was therefore respited, and the error in the verdict of the matrons was clearly proved by the birth of a child on the 28th December!

The value of the opinion of a jury of matrons upon such matters, may be estimated from the following facts. The late Dr. Reid records the case of an expert midwife who, when examined in the celebrated Gardner Peerage cause, deposed " that she had herself once gone ten months with child,—that she was always right in her calculations—that she always fainted away at quickening, &c., so that she could never be deceived." Some time after the trial she applied to Dr. Reid, convinced on such grounds that she was seven months pregnant. But on examination, Dr. Reid found that there was no pregnancy at all!

There seems to be no uniform rule of practice in such cases. In *Reg.* v. *Featherston* (Chester Aut. Assizes, 1854), prisoner was convicted of the murder of her child, and a plea of pregnancy was put in by her counsel. A jury of matrons, taken from women present in Court, was empannelled and sworn to try whether she was quick with child, &c. After an examination of the prisoner, the jury by their forewoman said:—" The prisoner is not quick with child: she is not in the family way." In *Reg.* v. *Weeks* (Exeter Lent Assizes, 1856), this plea was urged in stay of execution on a capital conviction for murder. A jury of matrons was sworn in the usual way to inquire into the fact, and " two doctors" were sworn to examine the prisoner and give evidence before the jury of matrons. After a short time they found that the prisoner was pregnant, and sentence was respited until after delivery.

It is unnecessary in the present day to discuss the question, whether, until the period of quickening, the child is or is not "*pars viscerum matris.*" The vulgar opinion is, that the fœtus only receives life when the woman quickens: but the law should not base its decisions in reference to capital punishment upon vulgar opinions. As ovum, embryo, or fœtus, the contents of the uterus are as much endowed with special and independent vitality in the earlier as in the later periods of gestation. It is, then, absurd to fix upon an accidental and uncertain symptom, occasionally felt by a pregnant woman, as the point at which clemency may be shown. The bare proof of *pregnancy*, as in the law of France (Art. 27 of the Penal Code), should be sufficient to authorize a suspension of the sentence. The doctrine of quickening has been abandoned in relation to the law of criminal abortion; and there is still greater reason for its immediate abolition in reference to pregnant females capitally convicted.

This change would, however, be attended with but little benefit if the decision of the question of pregnancy were still to remain in the hands of "matrons." The record of their mistakes sufficiently establishes the correctness of this view: for if they are unable to recognize the pregnant state at the fifth month, and if, as experts, they are liable to be deceived about their own condition, they cannot fail to be mistaken in their opinions at earlier periods. It is, indeed, an extraordinary circumstance, that when married women advanced in pregnancy are themselves continually deceived, and are obliged to consult medical men respecting their condition, they should be specially selected by the law as the persons best qualified to pronounce an opinion upon the pregnancy of a female, in a case involving the infliction of capital punishment. It would be considered inhumane to execute knowingly a pregnant woman, but the imputation of inhumanity is not the less deserved by a law which virtually leaves the issue in the hands of ignorant and incompetent persons. The Americans are certainly in advance of us in their legislation on this subject. Thus, by the revised statutes of New York, when pregnancy is pleaded in bar of execution, it is enacted that the sheriff shall summon a jury of *six physicians*, and shall give notice to the district attorney, who shall have power to subpœna witnesses.

These are, I believe, the only two cases in which pregnancy has any direct relation to medical jurisprudence: and it is remarkable, that with respect to them, the law of England has expressly provided that they should be left to the decision of non-medical persons! The following conclusions may therefore be drawn:—1. That the cases in which the signs of pregnancy become a subject of *legal* inquiry in England are rare:—2. That there is no case in English law, in which a medical man will not have an opportunity of performing an examination *per vaginam*:—3. That a medical opinion is never required by English law-authorities, until the pregnancy is so far advanced as to render its detection *certain*. Hence discussions concerning areolæ, the condition of the breasts, the presence of kiestein in the urine, &c., are in a practical point of view unnecessary to a medical jurist. By these remarks I do not intend to undervalue the importance of an accurate knowledge of the signs of pregnancy to a medical practitioner. Cases which may never come before a Court of Law will be referred to him, and the serious moral injury which he may inflict on an innocent female by an inaccurate opinion should make him scrupulously cautious in expressing an opinion. The case of *Lady Flora Hastings* furnishes a sad illustration of the effects of such an error. On this subject the reader may profitably consult a paper by Dr. Nelson (Lancet, Nov. 22, 1851, p. 485). On other occasions his own reputation may suffer by a mistake on this subject. A married lady in Scotland, who had not had a child for a long period, thought that she had become pregnant, and consulted the chief physician in the place, a man of skill and experience (now deceased). He saw this lady several times, and had every opportunity of examining her condition. He gave a decided opinion that she was *not* pregnant. The lady, however, made her preparations, and one night, not long after the medical opinion had been formally given, the physician was sent for to aid in the delivery!

Concealment of Pregnancy.—By the law of Scotland, if a woman conceals her pregnancy during the whole period thereof, and if the child of which she was pregnant be found dead, or is amissing, she is guilty of an offence, and is liable to prosecution. Evidence is sometimes given as to outward appearances indicative of pregnancy; but the main proof of a woman having been pregnant, and that which is relied on for conviction, is clear and distinct evidence of the actual delivery of a child. This is generally furnished by medical witnesses. The Scotch law, by making the concealment of pregnancy, under the circumstances above mentioned, an offence, proceeds on the principle that every pregnant female is bound to make preparations for the safe delivery of a child; and it is therefore assumed that if a child be born clandestinely, without preparation, and is found dead or is amissing, its death is owing to the want of such preparation.

Pregnancy in a state of unconsciousness.—It was formerly a question whether a woman could become *pregnant* without her knowledge. This may undoubtedly happen, when intercourse has taken place during profound sleep (lethargy), or when a female has been thrown into this state by narcotic drugs or vapours. But it is difficult to admit that any woman should remain pregnant up to the time of her delivery, without being conscious of her condition, if the intercourse took place during the waking state. A woman endowed with ordinary intellect could not avoid *suspecting* her condition after the fourth or fifth month: and this alone would be sufficient to induce her to seek advice whereby the fact would become known to her. When a woman is impregnated in a lethargic state, it is unlikely that she should go beyond the sixth month without being fully aware of her pregnancy, as a female with innocent motives would undoubtedly make some communication to her friends. Capuron mentions a case of this kind, in which the fact of pregnancy was first ascertained at the end of the fourth month, by the female having complained to one of her sisters of a strange sensation which she experienced in the lower part of her abdomen. (Méd. Lég. des Accouchemens, p. 86.) In a case related by Mr. Skey, a young female who had intercourse knowingly, was supposed not to have been aware of her pregnancy until the seventh month; but there is reason to believe that this woman was guilty of deception. (Med. Gaz. vol. 29, p. 212.) There are generally, in these cases, strong motives for falsehood; hence such stories require close investigation before they are allowed to influence the opinion of a practitioner. A case occurred in September 1857, in which a woman, æt. 22, described as modest and decorous in her behaviour, then advanced to the sixth month of pregnancy, asserted that she had not consciously had connection with any one, although she specified a date at which she remembered she had lost her consciousness—at which date intercourse might have been had! On being questioned, she denied that she had had at any time any soreness or pain in her private parts. Although there may be unconscious intercourse and pregnancy, it is not probable that in the case of a virgin there should be such intercourse without the production of pain, soreness, or laceration; and these symptoms, if not perceived at the time, should be felt subsequently and create a suspicion, if not an actual knowledge, of what had happened. This rendered the account which she gave wholly improbable. The fact that she was able to fix a date for her unconsciousness, with an accuracy in accordance with her condition, was also a suspicious circumstance. It is quite possible that women who are living in connubial intercourse may become pregnant without being conscious of it. Dr. Rüttel mentions the case of a female, æt. 41, who had been married upwards of sixteen years, and who, while returning from a neighbouring village, was suddenly delivered of her first child, when she had only a few days before been complaining that she was not likely to have any children. The child was born living and mature. (Henke, Zeitschrift der S. A. 1844, p. 264.) Mr. Long met with a case in which a married woman, æt. 24, subject to irregular menstruation, consulted him for an attack of spasms. On his arrival, he found that she had suddenly given birth to a seven months' child. Neither her husband nor herself had the slightest idea that she was pregnant. She had noticed that she had become somewhat stout, and that her breasts were more full than natural. She attributed her condition to improved health, and the cessation of the menstrual discharges was set down to some accidental cause. (Med. Times and Gazette, June 13, 1857, p. 592.)

I am indebted to a distinguished judge for the following fact in reference to unconscious pregnancy:—A married lady, who had not had a child for a period of nineteen years, found herself, as she thought, getting unusually stout. She was moving about with her family to different places. At last her size alarmed her, and she thought she was suffering from dropsy: she consulted a physician, who informed her that she was in an advanced state of pregnancy. She treated this opinion with great contempt. In travelling with her daughter, they arrived at a miserable inn: on the night of their arrival, this lady was seized with the pains of labour, and was delivered of a child. She had made no preparation for the birth, and, up to the moment when she was seized with labour-pains, she had not, with all her former experience, the slightest idea that she was pregnant. (For other cases in which married women have had no consciousness of pregnancy, see Lancet, June 16, 1860, p. 609, and June 30, 1860, p. 643.) Instances of this kind are important in reference to alleged unconscious delivery in females charged with infanticide. At the same time, many of the cases in which there are motives for pleading unconscious intercourse or pregnancy require close examination. They will frequently be found to be quite unworthy of belief.

Pregnancy in the dead.—There is no special case in law wherein the *fact of pregnancy* requires to be verified after the *death* of a female: but an examination may be necessary in order to determine the identity of a body, or to rescue the reputation of a woman from a charge of her having been unchaste. The discovery of an embryo or fœtus in the uterus would of course at once solve the question, when the necessity for an examination occurred, and the practitioner will remember that, even supposing many years to have elapsed since interment, and the body to have been reduced to a skeleton, still if the fœtus had reached the period at which ossification takes place, traces of its bones will be found amidst the bones of the woman. In examining the body of a female long after death, for the purpose of determining whether she was or was not pregnant at the time of death, it may be proper to bear in mind that the unimpregnated uterus undergoes decomposition much more slowly than other soft organs. In the case of a female who had been missing for a period of nine months,—whose body was found in the soil of a privy, so decomposed that the bones separated from the soft parts, the uterus was of a reddish colour, hard when felt, and its substance was firm when cut. The fact was of importance. It was alleged that the deceased was pregnant by a young man, and that in order to conceal her condition he had murdered her. From the state of the uterus, Casper was able to affirm that this organ was in its virgin condition, and that the deceased was not pregnant at the time of her death. On this representation the accused was liberated (Ger. Leich Oeffn. vol. 1, p. 93.) In examining bodies many months after interment, and in one case upwards of a year, I have been surprised to find, that while other soft organs were decomposed, the uterus had scarcely undergone any change. Its substance was still firm and hard.

It may happen that the appearances in the uterus are sufficient to create a strong suspicion that the woman had been pregnant, but the ovum, embryo, or fœtus may have been expelled. In this case several medico-legal questions may arise in reference to delivery.

DELIVERY.

CHAPTER 49.

DELIVERY IN ITS LEGAL RELATIONS—DELIVERY IN THE LIVING—CONCEALED DELIVERY—ABORTION IN THE EARLY STAGES OF PREGNANCY—THE SIGNS SPEEDILY DISAPPEAR—EARLY EXAMINATIONS—SIGNS OF RECENT DELIVERY IN ADVANCED PREGNANCY—EVIDENCE FROM THE SKIN OF THE ABDOMEN—THE ORGANS OF GENERATION—THE PRESENCE OF THE LOCHIA—SIGNS OF DELIVERY AT A REMOTE PERIOD—FEIGNED DELIVERY—DELIVERY IN A STATE OF UNCONSCIOUSNESS—CIRCUMSTANCES UNDER WHICH THIS MAY OCCUR—NATURAL AND MORBID SLEEP—ADMISSION OF THE PLEA IN CASES OF ALLEGED CHILD-MURDER—SIGNS OF DELIVERY IN THE DEAD—APPEARANCES OF THE INTERNAL ORGANS IN CASES OF RECENT DELIVERY—THEIR RAPID OBLITERATION—TRUE AND FALSE CORPORA LUTEA—FALLACIES TO WHICH THEY GIVE RISE—EXAMINATION OF THE OVUM OR EMBRYO—ITS CHARACTERS FROM THE FIRST TO THE SIXTH MONTH—MOLES AND HYDATIDS—MEDICO-LEGAL CASES.

Legal relations.—Delivery is a subject which much more frequently requires medico-legal intervention than pregnancy. It will be sufficient to state that the concealment of birth, the crimes of abortion and infanticide, with questions relative to supposititious children, are closely dependent on the proof of parturition. This subject will admit of being considered under two heads:—1. As it relates to delivery in the *living*;—2. As it relates to delivery in the *dead*. In undertaking the investigation, we ought, if possible, to ascertain, either from the female herself or from those around her, whether there was reason to suspect that she had been pregnant. If we can acquire any knowledge on this point it will materially facilitate our inquiry; but this is not always possible. It has generally happened, that previous pregnancy has been so concealed, that few who saw the woman suspected her condition; then again, as the admission of her delivery by a living female may be the strongest proof of her criminality, she will perhaps resolutely deny it; and a medical practitioner has no right to extort this admission from her. From this it will be seen that a medical witness must often be prepared to prove the fact of delivery, against the subject of the criminal charge.

Delivery in the living. Concealed delivery.—The signs of delivery in a *living* female vary materially, according to the time at which this event has taken place. In common language, if the contents of the uterus be expelled before the sixth month, the woman is said to miscarry, or to have an abortion: if after the sixth month, she is said to have a premature labour. The law does not admit any such distinction: the expulsion of the ovum, fœtus, or child by criminal violence, at any period of utero-gestation, is regarded as a miscarriage or abortion. It will therefore be proper, in treating this subject, to commence with the earliest period at which the contents of the uterus may be expelled, and to make no artificial distinction between the signs of abortion and delivery. It has been well observed, that the signs of delivery are indistinct in proportion to the immaturity of the ovum. Thus, when it takes place at the second or third month, there are scarcely any proofs which can be derived from the examination of a female. All the ordinary signs of delivery at the full period will be absent,—the development of the embryo not having been sufficient to cause any prominence in the abdomen, or to give rise to those changes in the system which take place previously to the birth of a mature child; *e. g.* enlargement of the breasts, and dilatation of the mouth of the uterus. Abortion at this period (the second or third month) is generally accompanied by loss of blood, which may manifest itself by its effects on the body. This, however, can only give rise to a suspicion. At a later period of gestation there may be a discharge resembling the lochia, and the mouth of the uterus may be found enlarged and soft; but from the small size of the fœtus the outlet will present no positive evidence of delivery. The quantity of blood lost may be greater, and may have a more decided effect on the system. Of course, if the ovum or fœtus be found, then the presumption of abortion is strongly supported: but those females who designedly conceal their condition, will commonly take effectual means to prevent the examiner from obtaining evidence of this kind.

These remarks relative to the state of the female, apply to an examination made *recently* after the abortion. If any delay take place (and this is a common occurrence), even the ambiguous signs which have been mentioned speedily disappear; so that after a period, which is short in proportion to the earliness of the expulsion, no traces whatever will be discovered. Dr. Montgomery met with a case in which abortion took place, with considerable hemorrhage, at the close of the second month.

Twenty-four hours afterwards, the mouth and neck of the uterus were almost completely restored to their natural state. The vagina and external parts were hardly, if at all dilated, and very little relaxed; the breasts exhibited imperfectly, the appearances which accompany pregnancy, the ordinary sympathetic symptoms of which had been almost entirely absent. (Cyc. Pr. Med. 504; Devergie, vol. 1. p. 683.) In such a case as this,—and for such cases a medical jurist must be prepared,—scarcely a presumption could have been entertained of the fact of delivery. After twenty-four or thirty-six hours, in the greater number of cases of early abortion, we may expect to find from a personal examination of the female, no proofs whatever of this event.

In order to determine the signs of a "miscarriage," as it is termed by our law, at an advanced period of gestation, it will be necessary to describe those which are considered to be characteristic of delivery at the full period. There will be, in these cases only a difference in degree: the signs being more numerous and more clearly marked in proportion to the lateness of the period at which the contents of the uterus are expelled. The signs of delivery may be enumerated in the following order: —

Signs of recent delivery in the living.—The female is weak, the countenance pale; the eyes surrounded by livid areolæ, and there is an appearance of general indisposition. Any severe illness may, however, give rise to similar symptoms. Their sudden occurrence, from a state of previous good health, especially when pregnancy is known or suspected, will create a strong suspicion. The *breasts* are full, especially about the third or fourth day; the nipples are enlarged, and the areolæ around them present all the characters of advanced pregnancy.

1. The *skin* of the abdomen is relaxed, sometimes thrown into folds: the cuticle interrupted by light-coloured broken streaks, passing especially from the groins and pubes towards the umbilicus; and the navel is more or less stretched and altered. The round form of the enlarged and semi-contracted uterus may be felt at the lower part of the abdomen, generally lying towards one or the other side. The apparent size of this organ will depend upon the degree to which it has contracted, and therefore greatly upon the time at which the examination is made. Dr. Montgomery has pointed out the existence of a dark line extending from the pubes to the navel, with a dark areola around the latter, in cases of recent delivery: but he has found this line to exist independently of pregnancy and delivery in one case in a girl aged ten, and in another instance, in a lady labouring under ovarian tumour.

2. The *organs of generation* will be found externally swollen, contused, or even lacerated, with clots of blood about them.

The outlet is much dilated; the mouth of the uterus is considerably open, and its margin completely relaxed.

3. The *presence of the lochia.*—This is a discharge, at first of a sero-sanguineous liquid, but which afterwards appears as a brown or green-coloured serum. It commences soon after delivery, and continues from a week to a fortnight, or even longer. The lochial discharge has so peculiar an *odour*, that some have regarded this alone as furnishing strong evidence of recent delivery.

The signs which have been here enumerated are found only when no delay has taken place in making the examination, and the woman has been *recently* delivered. In some strong and vigorous females, the body resumes its natural state within a few days, and the traces of parturition may have either wholly disappeared, or have become so ambiguous as to furnish no satisfactory evidence. In others, again, evidence of delivery will be obtainable for a fortnight or three weeks afterwards. In most cases, however, it is difficult, if not impossible, to say, after the lapse of *eight or ten days*, that delivery has certainly taken place, the signs having commonly by that time disappeared. In all cases, the earlier the period at which the examination is made, the more satisfactory will be the evidence obtained. Dr. Montgomery once examined a female, *five days* after delivery at the full time, and he was particularly struck with the degree to which the parts had become restored to their ordinary condition, especially the mouth and neck of the uterus, which hardly differed from their natural unimpregnated form. (Cyc. Pr. Med. loc. cit.) In cases of abortion at an early period the placenta is not always discharged at the time. (Med. Times and Gaz. March 12, 1859.)

Signs of delivery at a remote period.—A question may arise, whether it is in the power of a medical practitioner to determine the period at which delivery took place, *i. e.* how long a time has elapsed. This becomes necessary when, in cases of concealed birth, abortion, or infanticide (some time after suspected parturition), a child is found, and it is required to determine, whether the time which has elapsed since the birth of the child, either dead or living, corresponds with the supposed delivery of a suspected female. An opinion may be given, within eight or ten days after delivery, from the state of the breasts, of the discharges (lochia), and of the mouth of the uterus; but it becomes difficult after the sixth day: and when the tenth or twelfth day has passed, it is still more difficult. After two or three months, it may be regarded as impossible to assign the period of delivery with any degree of precision. (See Devergie, Méd. Lég. vol. 1. p. 446.)

Again, in a case of pretended delivery, contested legitimacy, or disputed chastity, (*Frazer* v. *Bagley*, see *post*, DEFLORATION), a medical jurist may be required to say, whether a female has, at any antecedent period of her life, been delivered. This question, it must be remarked, can be raised only in respect to delivery at the full period, since there is no doubt that abortion in the early stages of pregnancy may take place, and leave no traces of such an event discoverable in after-life. Indeed, a few days or weeks are sometimes sufficient to obliterate all evidence of the fact. With respect to delivery at the full term, certain signs have been mentioned, which by some are considered indelible. These are,—shining streaks on the skin of the abdomen, a brown mark reaching from the navel to the pubes, and the state of the mouth of the uterus, which is said never to close so effectually as in the virgin. In regard to the appearance of the skin of the abdomen, it may be remarked, that any morbid causes giving rise to a distension of the cavity,—as ovarian enlargement or dropsy,—will produce the same effect:—so, also, to a certain extent, extreme emaciation from a state of obesity. (See Med. Times and Gaz. April 17, 1861, p. 450, on false cicatrices.) Then, again, these marks on the skin are not always persistent throughout life. Besides, a woman may be, according to the statements of good observers, not only once, but repeatedly delivered, without having these marks produced. (See on this appearance Med. Times and Gaz. June 9, 1860, p. 583.)

With regard to the state of the mouth of the uterus, it is liable to vary in different females, and to be affected by disease,—so that a certain judgment cannot always be formed from its condition. In a female who has not borne children, the mouth of the uterus is in the form of a slit, the angles being bent down, and giving to it the appearance of the os tincæ (tench's mouth). Mr. Whitehead has observed that, in a woman who has borne children, the mouth becomes elongated, and loses the slight bend at each of its extremities: the labia are thickened, and more nearly of equal size; the commissures are less clearly defined, and the whole of the neck is enlarged, and not so compact in texture. (On Abortion, p. 195.) It must be remembered, however, that the condition of the mouth of the uterus, even in the virgin, varies at each menstrual period. Should there be occlusion of the vagina, or the hymen be found imperforate, this will at once negative a previous delivery; but the latter condition will not negative a previous pregnancy, since a woman may have been impregnated, and have had an abortion in the early stage of pregnancy, without a necessary destruction of the hymen. This sort of negative evidence may sometimes be of great value. There is a total want of good affirmative evidence of delivery at a remote period in the living, so that even a conjectural opinion can be expressed only with caution. It is rare, however, that any decision on this subject is required in medical jurisprudence. It might be demanded, either in a case of infanticide, when a woman was accused of having destroyed her alleged offspring some months or years before; or in a case of contested legitimacy, when a female is accused of having substituted a child of which she pretends she has been delivered at some remote period of time.

Feigned delivery.—Delivery has often been feigned by females, for the purpose of extorting charity, compelling marriage, or disinheriting parties who have claims to an estate, and in other cases without any assignable motive. Of course, an imposition of this kind could not be sustained before a medical practitioner: and detection is rendered easy, because it is *recent* and not *remote* delivery which is assumed. The latter would, if pretended, be generally cleared up by an examination, as well as by circumstantial evidence. (See case, Med. Gaz. vol. 19. p. 231; also another by Capuron, Méd. Lég. des Accouchemens, p. 110.)

Can a female be delivered unconsciously?—Another important question relative to delivery in a living female is, whether a woman can be delivered without being *conscious* of it. The signs of delivery may be discovered by a practitioner; the offspring may also be found. The female may admit the fact of her delivery, but allege that she was totally unconscious of it. The only medico-legal case in which this plea is occasionally raised is in infanticide; and as the possibility of the occurrence may be questioned, the practitioner must be provided with a knowledge of those facts which medico-legal writers have accumulated respecting it. There is no doubt that a female may be delivered unconsciously, if she be labouring under coma, apoplexy, asphyxia, or syncope; or if labouring under the effects of narcotic poisons, the vapours of chloroform and ether, or intoxicating liquors. It is said, also, that delivery has taken place spontaneously while a female was in the act of dying. This, however, has no bearing on the present question. It is in those cases where a female, after her recovery, pleads unconsciousness of delivery, that medical practitioners are chiefly consulted. Besides the cases enumerated, hysteria, when accompanied by loss of sense and motion, has been mentioned as a state in which parturition is liable to occur unconsciously. We need not be surprised at delivery taking place under these circumstances, when we consider that the contractile power of the uterus is altogether independent of volition: but it is difficult to believe, unless the morbid states already mentioned are accompanied by the most profound lethargy and entire loss of sensation, that the contractions of this organ, in its efforts to expel the child, should not suffice at once to rouse the individual into consciousness. We ought particularly to expect this in primiparous females, *i.e.* in those who have never borne children. At the same time it must be remembered, that parturition with some females, especially when the pelvis is wide and the child small, may take place with such rapidity and ease, as scarcely to be accompanied by pain.

It has been observed, that when a woman has frequently borne children, delivery sometimes takes place without effort, and without any consciousness on her part. On other occasions, the female may lie in a kind of torpor or stupor, and have no recollection of her delivery. Mr. King has described the case of a woman, aged thirty-six, the mother of nine children. She received his assistance in her tenth labour: when summoned, she was lying calmly and placidly in bed, and was perfectly insensible. He found that the child had been expelled with the placenta. The woman did not recover her sensibility for ten or twelve hours, and then stated that she had no recollection of the birth of the child, or of any circumstances connected with that event. She suffered no pain or uneasiness. Another case is mentioned by this gentleman, in which sensation appeared to be entirely paralyzed during labour. (Med. Times, May 15, 1847, p. 234.) It is beyond doubt, that profound lethargy occasionally makes its appearance about the time of delivery. Dr. Schulze met with a case in which a female remained in a state of sleep for three days, and was delivered while in this unconscious condition: on awaking, she had no recollection of having suffered any pain during delivery. (Ann. d'Hyg. 1845, vol. 1. p. 216; Med. Gaz. vol. 36. p. 40.) Dr. Montgomery relates the case of a lady, the mother of several children, who, on one occasion, was unconsciously delivered during sleep. (Cyc. Pr. Med. See also case in B. and F. Med. Rev. No. 9, p. 256.)

The results obtained by the use of the vapours of chloroform and ether, show that the expulsive efforts of the uterus are often as energetic in the unconscious, as in the conscious state. It may appear extraordinary, however, that a primiparous female, unless rendered unconscious by narcotic substances, should be delivered without suffering pain: nevertheless, a case of this kind is recorded by Dr. Wharrie. The woman's age was twenty-one; she had been in labour about six hours: she complained of no pain, and the child was borne without effort or consciousness. The child was healthy, but small, weighing rather more than four pounds. (Cormack's Journal, Jan. 1846, p. 12.) Notwithstanding this case, it is in the highest degree improbable that any primiparous female should be delivered during *ordinary sleep*, without being roused and brought to a sense of her condition.

There is another condition in which a woman may state that her delivery took place unconsciously: and this, from its being one of the most common species of defence set up by a female charged with child-murder, must here claim our attention. Thus, she will allege that, while suffering from pain, she felt a strong desire to relieve her bowels: that she went to the water-closet for that purpose, and was there delivered without knowing anything of the occurrence, until it was too late to save the child. This kind of desire is a very common symptom of the parturient state; and, as it has been elsewhere remarked, it is often difficult in private practice to restrain a woman from yielding to the feeling, when it certainly would be attended with hazard to the child. (For a case of this kind, see Med. Times and Gaz. April 4, 1857, p. 347.) We must therefore admit that an accident of this kind is quite within the range of probability; although here, as in every other instance in which unconscious delivery is pleaded, a medical witness ought to inform himself, or to be informed, of all the particulars which are stated to have attended delivery, before he gives an answer applicable to the case. As a general rule, it cannot be denied that delivery may take place, under these circumstances, and a woman not be conscious of it: but before we make the admission in regard to any particular instance, we ought to have a full statement of the facts from the female herself. It is thus that we shall avoid the risk of seeing a premature medical opinion set aside by the subsequent production of circumstantial evidence. Besides, it has been properly observed, that *after* an accident of this kind, a woman cannot be ignorant of her having been delivered. Females who have raised this plea in cases of child-murder, have often been known to maintain that they were unconscious of their pregnancy; and thus have attempted to excuse themselves for not having prepared the articles necessary for childbirth. It is possible that a female may not be aware of her pregnancy in the earlier stage; but it is scarcely credible that she should remain ignorant of it in the later period of gestation, or up to the time of her delivery. It is at least to be presumed that she must have had some reason to *suspect* her condition; and if only a suspicion existed in the mind of a woman who did not contemplate the destruction of her future offspring, there would assuredly be many circumstances forthcoming which would establish her innocence. If this remark applies to married women, it applies with still greater force to those who are unmarried, since the fact of illicit connection and the fear of its consequences must render them peculiarly alive to all those changes which, by common repute, take place in the female system during pregnancy.

Signs of delivery in the dead.—It will now be proper to examine the signs of delivery which are derivable from an examination of the body after death. Occasionally we may obtain some account of the female during life, by which our labour will be much facilitated; but, on the other hand, every fact may be studiously concealed from us, and then we may be required to prove not only the delivery, but the previous pregnancy. These investigations relative to pregnancy and delivery in the dead body, are almost exclusively confined to cases of criminal abortion, where the contents of the uterus have been expelled at the sacrifice of the life of the woman. Death commonly ensues in these cases within two or three days after delivery, and then satisfactory proofs are obtainable on an examination of the body; but if the female has survived three or four weeks, it will be as difficult to determine delivery in the dead as in the living subject. This remark applies to delivery at the full period; for if the uterus have expelled its contents in the first months of pregnancy, the traces of this expulsion will have generally disappeared in the course of a few days.

According to Burns, the following may be taken as the chief appearances when the body is examined soon after the delivery at the *full* period. The uterus is like a large flattened pouch from nine to twelve inches long, its mouth being wide open. The cavity contains coagula of blood or a sanguineous fluid: and its surface is covered with the remains of a decidua. In the part to which the placenta has been attached, the substance of the organ appears exposed, presenting several large semilunar or valvular openings. This portion of the uterus is of a very dark colour, so as to have given rise to a suspicion that the organ was gangrenous. The vessels are extremely large and numerous. The Fallopian tubes, round ligaments, and ovaria, are so vascular (full of blood) that they have a purple colour. The spot whence the ovum has escaped is more congested than the rest of the ovarian surface. Obstetric writers differ greatly in their statements respecting the size of the uterus at different periods after parturition; and these differences may be explained, partly by the fact that the uterus contracts more rapidly in some females than in others, and partly, perhaps, by the circumstance of the birth having been, in some instances, premature. Dr. Montgomery states that, after delivery at the full period, and under perfect contraction of the uterus, if the body be examined within a day or two, it will be found seven inches long and four broad. Its parietes, on making a section, will be from an inch to an inch and a half in thickness, and will present the orifices of a great number of large vessels. At the end of a week the organ is between five and six inches, and at the end of a fortnight about five inches in length:—the density of the parietes has during this period increased, but their thickness or substance has considerably diminished. The inner surface is still bloody, and covered partially with a pulpy substance resembling the decidua. The orbicular direction of the fibres around the internal orifices of the tubes is at this time very distinct. In about a month the uterus will have become fully contracted; but the mouth rarely, if ever, closes so completely as in the virgin state. In a case examined by Dr. Barnes, in which a primiparous female, aged twenty-six, died from puerperal fever on the *sixth day* after delivery, the following appearances were met with in the uterus. The internal surface was blackened and congested, especially in those parts to which the placenta had been attached. There was the appearance of suppurative action in this part. The substance of the uterus was healthy: there was no pus in the sinuses. The os uteri showed considerable ecchymosis. The vagina was healthy; the iliac veins contained nothing but loosely coagulated blood. There was in the left ovary a small well-marked corpus luteum, having a central cavity. (Med. Gaz. vol. 41. p. 294.) This condition of the uterus must not be confounded with the appearances which are observed when death takes place during *menstruation*. Dr. Judee found in the bodies of three females who died during menstruation that the uterus was somewhat enlarged,—its walls being thickened and its interior lined by a reddish gelatinous layer about 1-12th of an inch thick consisting of a capillary net-work of vessels, enclosed in a mucous-like membrane. When this was removed the uterus below was found to be white and firm. The interior of the neck was of a greyish colour: the lips were swollen, of a dull-red,—bluish or even black colour. On compressing this part small drops of blood issued. This was not observed either in the neck or body of the vagina. A section of the uterus presented only the normal fibrous tissue: but at the level of the mouth (os uteri) there was a magma of tissue resembling a portion of apoplectic lung. The blood during menstruation, according to this gentleman, issues entirely from the highly congested mouth of the uterus. (Gaz. des Hôpitaux, No. 39, and Med. Times and Gaz. June 23, 1855.)

From the statement of appearances given above, it will be seen that there must be considerable difficulty in determining the period prior to death at which delivery took place. The difficulty is increased when a female has been prematurely delivered, or if death has not taken place until some time after delivery. A medical opinion may be then in some degree strengthened by searching for those signs which have been described as characteristic of delivery in the living. These, if present, will always furnish strong corroborative evidence, not only of the fact of delivery, but of the period at which it had probably occurred.

Evidence afforded by the presence of corpora lutea.—The condition of the *ovaries* has been considered to furnish strong evidence in the dead body, not so much of delivery as of previous pregnancy. These organs, as it has been already stated, when examined soon after delivery, are found of a deep purple colour, owing to their extreme vascularity. If the female has really been pregnant, we may expect to find, on one or the other of these bodies, the appearance which is denominated a *corpus luteum*. The accounts given by obstetric writers of the characters of corpora lutea and the evidence which they are capable of furnishing in legal medicine, are very conflicting. Dr. Montgomery states that, in the *true* corpus luteum (*i. e.* of pregnancy), the ovary presents a protuberance with a distinct cicatrix on some part, whence the ovum has escaped. The protuberant part will be found on section to have an oval form and to be of a dull yellow colour. It is full of blood, and in texture resembles the section of a kidney. In the centre of this section there will be either a *cavity* or a radiated white *cicatrix*, according to the period at which an examination is made. The cavity remains for about three or four months after conception, and is surrounded by a strong white cyst:—as gestation advances, the opposite sides approximate and a radiated white cicatrix results. The size and vascularity of the corpus luteum are considerably diminished by the time gestation is completed; and in about five or six months afterwards, *i. e.* fourteen months after its first formation, it disappears altogether from the ovary, so that the corpus luteum of one conception is never to be found with that of another, unless a premature expulsion of the contents of the uterus has taken place. (Cyc. Pr. Med. Pregnancy, p. 496; see also Edinb. Monthly Journal, Jan. 1845, p. 58.) The presence of a corpus luteum, as it is here described, does not prove that a woman has borne a child. In the opinion of some obstetric authorities, it establishes that conception has taken place: but the embryo may have been converted into a mole or a blighted fœtus, and expelled at an early period. It was formerly supposed that *one* true corpus luteum only was met with in pregnancy with one child; but among other facts which show that such an inference is erroneous, is a singular case reported by Dr. Renaud to the Manchester Pathological Society. He examined the body of a female who died in the seventh month of her pregnancy, and from whose uterus he extracted a fœtus. There were no traces of a blighted ovum. The ovary, however, presented *two* distinct and well-marked corpora lutea. (Med. Gaz. vol. 39, p. 599.) Had the ovary alone been examined, it might have been supposed that this female had had twins.

The characters of what has been hitherto denominated the *false* corpus luteum have been thus described:—1. There is no prominence or enlargement of the ovary generally, at the part where it is situated. 2. The external cicatrix is wanting. 3. There are often several in both ovaries. 4. The texture is not glandular, nor can it be injected. 5. When laid open by section, it has neither a central cavity, nor the peculiar radiated *cicatrix* which results from its closure. Dr. Paterson has published some remarks on this subject, with medico-legal cases and plates. (Ed Med. Sur. Jour. vol. 53, p. 49.) According to this gentleman, the *false* are to be distinguished from the *true* corpora lutea by the following signs. The false bodies have in general an irregular form, and want either a central cavity lined with a distinct membrane, or a *puckered cicatrix*. They have no concentric radii, and are frequently numerous on both ovaries. He relates the following case, in order to show that the presence or absence of a *true* corpus luteum may be sometimes important in a question of disputed identity in the dead. Four medical students were charged with having disinterred the body of a lady; but the body was so disfigured that the deceased could not be identified by her relatives. In one of the ovaries a *true* corpus luteum was reported to have been found; a discovery which, if true, proved that it could not be the body of that lady, since she was a virgin, and advanced in life. On the trial the medical evidence was very conflicting; one half of the witnesses maintained that the body which was found in the ovary was a true corpus luteum, while the others contended that it was not! Dr. Ramsbotham agrees with Drs. Montgomery and Paterson in considering that the true corpus luteum, *i. e.* that derived from conception, is known either by its having a *central cavity*, sometimes unoccupied, at others filled with the blood which was effused at the time that the coats gave way, or if it should be of more ancient date, by its presenting stelliform *radiated white lines* (a puckered cicatrix), resulting from the closing of this cavity. (Obstetric Medicine, p. 49.) The reader will find the appearances described, well delineated in Dr. Ramsbotham's work.

In opposition to the views of Drs. Montgomery, Paterson, and Ramsbotham, Dr. Knox, an experienced anatomist, asserts that there is no distinctive character whereby what has been called the *true*, can be known from the *false*, corpus luteum, the only difference being that the latter is smaller. What have been called corpora lutea may be formed in virgin animals, independently of intercourse; and the time of their disappearance from the ovary varies from three months to an almost indefinite period. (Med. Gaz. Dec. 22, 1843.) That there is considerable difficulty in distinguishing true from false corpora lutea, is proved by reference to a case reported in the Medical Gazette (vol. 34. p. 623) in which two experienced observers differed. Dr. Lee thought that the preparation which was the subject of examination was not a corpus luteum, while Mr. Wharton Jones thought that it was,—founding his decision on a microscopical examination. This difference of opinion shows that a distinction is by no means so simple a matter as some writers assert. Mr. W. Jones agrees with Dr. Knox in considering that a corpus luteum may occur in the ovaries, independently of intercourse; and that the existence of one in this organ would therefore afford no proof whatever of intercourse having taken place. The discovery of the *ovum* in the uterus, *in process of development*, could alone, in the present state of our knowledge, warrant an affirmative opinion on this point in a Court of law; and this I believe to be the safest view of this much-contested question. On the other hand, the absence of a corpus luteum from the ovary would not in all cases warrant an opinion that conception had not taken place.

These views regarding the evidence derivable from the presence of corpora lutea have received considerable support from the researches of Professor Bischoff. (Med. Gaz. vol. 35. p. 443, et seq.) The experimental investigations of this gentleman appear to show that the extrusion of an ovum, or the production of a corpus luteum, is by no means necessarily connected with conception:—that the ova undergo a periodical maturation, about the time of menstruation, and escape whether there be conception or not;—therefore that fecundation is only likely to occur when intercourse is had about this period. This is also the opinion of Raciborski: indeed, some physiologists now regard menstruation as the alternative of conception (see Dub. Quart. Jour. May, 1846, p. 426), and consider that there is no period so favourable to conception, as that which immediately follows the cessation of the menses. In this respect the Koran appears to conflict with the laws of physiology, since it is laid down by Mahomet that females are impure for eight days before, and eight days after menstruation. (Rostan, Cours d'Hyg. t. 2. p. 438.) The same custom, according to Meigs, exists among the Jews as to the period at which a woman is clean after the cessation. (Obstetrics, p. 128.) It is not a little singular that this comprises the period at which, according to modern theories, conception most readily takes place. Women may conceive during the flow of the menses: it is also well ascertained that a woman who has never menstruated may conceive, and that conception may take place one or two days *before* the period of menstruation. Raciborski has met with several instances in illustration of these views. (Advances in Physiology, Baly and Kirkes, p. 59.) In the theory above given, we have an explanation why corpora lutea, or bodies closely resembling them, are so often found in virgin animals, and it would also account for those differences of opinion among experienced men, which almost invariably occur when it becomes a debated question whether a corpus luteum is true or false. The theory would further explain cases like the following, reported by Mr. Elkington:—A woman aged forty-two, who had not borne a child for *seven years*, died from diseased lungs. On the right ovary were two corpora lutea: and the Fallopian tube on that side was larger and more congested than on the other. The deceased expected to menstruate on the day she died, or at least one day later. (Prov. Med. Jour. Feb. 1845, p. 104.) Dr. Ritchie, of Glasgow, has arrived at results which tend to confirm the views of Professor Bischoff and Mr. W. Jones. He calls the bodies corpora menstrualia vel periodica. They may, in his opinion, be formed independently of pregnancy, and may possibly assume all the characters of what are called corpora lutea, by some reflex excitement in the uterine organs. According to this gentleman there are no fewer than eight varieties, which are liable to have their characters intermixed. (Med. Gaz. vol. 36. p. 985, 1058.) A recent case, in which a well-marked corpus luteum was found coinciding with menstruation in a female who had been executed, is reported by Dr. Michel. (Med. Gaz. vol. 44. p. 307.)

A full account of the general and microscopical characters of true and false corpora lutea, by Dr. Renaud, will be found in the Edinburgh Monthly Journal, August 1845, p. 589. (See also Recent Advances in Physiology, by Drs. Baly and Kirkes, 1848, p. 46.) These gentlemen conclude from their researches, that cases can seldom occur in which the mere presence of a corpus luteum can be taken as a proof of previous impregnation; and they consider the following rules to be deducible from the facts which they have collected. 1. A corpus luteum in its early stage (that is, a large vesicle filled with coagulated blood, having a ruptured orifice, and a thin layer of yellow matter within its walls) affords no proof of impregnation having taken place. 2. From the presence of a corpus luteum, the opening of which is closed, and the cavity reduced or obliterated, (only a stellate cicatrix remaining,)—no conclusion as to pregnancy having existed can be drawn, if the *corpus luteum be of small size*, and does not contain so much yellow substance as would form a mass the size of a small pea.—3. A similar corpus luteum of larger size than a common pea would furnish strong *presumptive* evidence, not only of impregnation having taken place, but of pregnancy having existed during several weeks at least; and the evidence would approximate more and more to complete proof, in proportion as the size of the corpus luteum was greater. (Op. cit. p. 57.)

From this statement, it will be perceived that the difference is only relative and arbitrary, chiefly depending on the *size:* and as in pregnancy corpora lutea are found of variable size, while in menstruation they may, under great excitement, attain a large size, it is obvious that no safe inference can be drawn from their presence, irrespective of other signs of impregnation. The terms *true* and *false*, therefore, are inappropriate; and the most serious mistakes may arise by a reception of evidence on this point. The law requires absolute certainty, not merely probability or presumption; and, in the present stage of physiology, the proof falls short of that which is necessary to guide the verdict of a jury. At a trial for attempted abortion, *Reg.* v. *Goodall* (Notts Lent Assizes, 1846), on examining the body of the female on whom the attempt was alleged to have been made, it was found that she was *not* pregnant: but on inspecting the ovary, a corpus luteum was there discovered. This was described as *false*, apparently because there was no proof of impregnation. Had an embryo been found in the uterus, or had there been proof of its expulsion, it would probably have been described as *true*. Dr. Meigs, an experienced writer, says that corpora lutea may vary in size, but in all cases they are real. Physiologically speaking, they do not admit of a division into true and false. (Females and their Diseases, 1848, p. 43. See Ed. Mon. Jour. Oct. 1851, p. 305.)

From these considerations, therefore, it appears to me that the only conclusion to which we can come is, that medical evidence respecting the nature of a corpus luteum in an unknown case, if received in a Court of law at all, should be received with the greatest caution, and only from a witness of great experience. The old doctrine on this subject, that the presence of such a body on the ovary affords *certain* and undeniable evidence of impregnation, may be regarded as completely subverted.

Characters of the ovum or embryo to the sixth month.—Hitherto the examination has been confined to the female: but it is now necessary to describe the characters of the ovum or embryo at the early stages of pregnancy, since, when this can be procured, good medical evidence may be derived from an examination of it. If the ovum be expelled within a *month* after conception, it is scarcely possible to detect it, owing to its small size, and its being enveloped in coagula of blood. Burns examined three uteri, within the first month, where no expulsion had taken place, but even under these favourable circumstances he failed in discovering the ovum. At first the ovum contains no visible embryo; but it appears merely to consist of vesicular membranous coverings. According to this writer, when first distinctly seen through its membranes, it is of an oblong form and about a line (the twelfth of an inch) in length. At the *sixth week*, it is slightly curved, resembling, as it floats, a split pea. In the *seventh week* it is equal in size to a small bee; and by the end of the *second month* it is bent, and as long as a kidney-bean. After this, development goes on rapidly: the features are in part well marked, and the limbs are gradually formed. At the *third month*, the fœtus weighs from one to two ounces: when stretched out it measures about three inches, and the genital organs, although the sex is not distinguishable, are large in proportion to the rest of the body. The membranes are larger than a goose's egg. At the *fourth month* the fœtus is from five to six inches long, and weighs from two to three ounces; at the *fifth month* it measures from six to seven inches, and weighs from five to seven ounces; and at the *sixth month*, its length is from eight to ten inches, and its weight about a pound. (For the characters of the child beyond this period, see *ante*, p. 415.) The great difficulty will consist in determining the nature of the supposed ovum or embryo between the second and third month. In making the examination, it should be placed in water, and all coagula gently washed away or removed by some blunt instrument. Alcohol may be used as a substitute for water, after the blood has been removed. If the embryo cannot be found, the decidua and chorion may be recognised: — the former by its forming the outer investment with its smooth internal and rough external or uterine surface; the latter, by the villous appearance of that portion of it which would have become the placenta. Between the third and fourth month, the fœtus may be commonly identified without much difficulty.

Moles.—The substance expelled from the womb may have been what is termed a mole — a morbid production of a fleshy or of a bloody structure, appearing like a blighted ovum or placenta. It has been said that a mole is never formed in the virgin uterus, but that its presence always indicates previous sexual intercourse: this point, however, is far from settled. The term mole is also applied by some to coagula of blood, polypi, or hydatids. In one case reported, a mole and an ovum were expelled together,— a fact which proves that they may coexist. The symptoms accompanying a mole strongly resemble those of pregnancy: and the appearances produced by its expulsion are not to be distinguished from those attending the abortion of a fœtus at an earlier period of gestation. The only means of distinction would be derived from an examination of the expelled matters. The local injury produced by the expulsion of these bodies on the organs of generation, is by no means so great as that caused by delivery at the full period.

Hydatids.—The signs of pregnancy and delivery may be present in a female, and yet these may be owing to the existence of hydatids in the womb. It was formerly a question, whether conception or previous impregnation was or was not necessary to their formation. Dr. Koch, of Heiligenbeil, has reported a case in which they were probably produced independently of sexual intercourse. A healthy strong woman, 32 years of age, had been married nine years, and had borne four children without difficulty. At this time she was living apart from her husband, so that according to the declaration of both there could have been no intercourse. The menstrual function ceased after the weaning of the last child, and the patient observed that her abdomen became enlarged, as if she were again pregnant. After three months' suffering, during which she was continually upbraided by her husband in consequence of her condition, pains came on, and a hydatid mole (a cyst of hydatids) about the size of two fists was extruded. The hydatids were collected in a grape-like cluster, and the cysts varied in size from a hemp-seed to that of a walnut. (Wildberg, Jahrbuch der gesammten S. A. 1837, 1 Heft, 145.) Dr. Ramsbotham considers that the difference of opinion regarding the production of these growths in virgins, may be explained by the fact that two diseases, totally dissimilar in their origin, character, and progress, have been confounded. (Med. Times and Gaz., Feb. 26, 1853, p. 210.)

In a case communicated by Mr. Hunter to the Lancet, hydatids coexisted with pregnancy, and the mass came away on the birth of the child. (April, 1846, p. 430.) When the mass is expelled, it is found to consist of a group of vesicles or cysts of various sizes; but sometimes, when this disease follows intercourse, the cysts are found mixed either with the remains of a blighted ovum or a coagulum of blood. Unless the expelled matters be produced, it would be very difficult to say from an examination during life or after death, whether the uterus had contained an embryo or hydatids. These morbid growths may even be inclosed in an investing membrane similar to the decidua, and there may be the remains of a corpus luteum in the ovary: but it is not likely when carefully examined in water, that they can be mistaken for an ovum or embryo. (An interesting case of the conversion of an ovum into hydatids is reported in the Med. Gaz. vol. 46. p. 454.)

In examining the bodies of those who have died while labouring under uterine hydatids, it has been found that occasionally the whole of a blighted ovum is converted into them; but sometimes only a part is thus converted. The cysts vary in number; there may be only one large cyst, and it is said that this condition is more frequently met with when hydatids are combined with pregnancy or with a mole, than when alone. The hydatid cysts appear to be connected with the inner surface of the uterus, by the unchanged portion of the ovum or placenta; and thus, upon their removal, we might expect to find the uterine surface more or less similar to that of the gravid state, according to the degree of development which may have taken place in the ovum. Burns observes, that the relative magnitude of the vessels in the two states has not been ascertained; few opportunities being afforded for examining the state of the organ in this disease. According to Madame Boivin, hydatids are sometimes surrounded by an investing membrane similar to the decidua. In a case which occurred to Mr. Brown, the symptoms caused by uterine hydatids were mistaken by the female (a married woman who had had children) for those of true pregnancy. The catamenia had ceased for about four months, the breasts were enlarged, there was a darting pain through them, with soreness of the nipples, and morning sickness. In about a month, flooding took place, and the hydatids came away. (Obstetric Record, vol. 1. p. 21.) These facts may have an important bearing on medico-legal practice, and in this respect, the following case, reported by Dr. Chowne to the Westminster Medical Society, Nov. 1843, will be found of interest: — A woman was seized with pains resembling those of labour, and a mass of uterine hydatids was expelled, which were supposed to have been in the uterus about five months. When the woman was examined, thirty-six hours afterwards, there were all the signs of recent delivery about her. The parts of generation presented the usual appearances met with on the expulsion of a fœtus; the breasts were enlarged, the areolæ elevated, of a brown colour, the follicles prominent, and the organs evidently contained milk. The occurrence of this case led Dr. Chowne to think, that had the body of an infant been found with marks of violence concealed in the house where this woman lived, it would probably have been pronounced to have been her child. A medical man might have strengthened the suspicion of criminality by declaring that there were all the signs of delivery about her. It may be observed, however, that in such a case, the woman would probably have stated that no child, but some tumour, had come away from her; and a medical man would not be justified in swearing that appearances of delivery absolutely indicated, under all circumstances, that the woman must have been delivered of a *child*. On the contrary, it is a well-known medical fact, that similar appearances may arise from the expulsion of a mole or hydatids. Circumstantial evidence would be against her, only on the assumption that some person had wilfully concealed or made away with the substantial proofs of her innocence, *i. e.* the group of hydatids which had been expelled. Mr. Pearson has communicated to the Medical Times (Dec. 30, 1848), a case in which, after the expulsion of a mass of hydatids, there were all the appearances which are usually observed after delivery.

Some of the questions which have been here considered were raised on the trial of *Angus* for the murder of *Miss Burns*, at the Lancaster Assizes, 1808. It was alleged that the deceased was pregnant,—that the prisoner had administered corrosive sublimate to her for the purpose of inducing abortion, and that this had caused her death. A question was raised at the trial relative to the appearances presented by the uterus as indicative of recent delivery. On examining this organ, it was found to be considerably enlarged, and on its inner surface was a mark, about four inches in diameter, plainly discernible, to which the placenta had been apparently attached. The mouth of the uterus was much dilated. Indeed, the appearances were described to be such as might have been expected to be found two hours after the birth of a full-grown child. The evidence respecting previous pregnancy was conflicting; and the prisoner was acquitted, because the death of the deceased could not be distinctly traced to any criminal act on his part. The ovaries were not examined until after the trial, when a body which was considered to be a true *corpus luteum* was found on one of them; and some eminent authorities agreed that it indicated an advanced state of pregnancy. (See Paris and Fonblanque, Med. Jur. vol. 2. p. 179.) One medical witness appeared for the prisoner; and he contended that the state of the uterus did not justify the medical inference that there had been recent delivery. He assumed that the appearances might have been due to the expulsion of a group of hydatids. On the whole, the medical defence, so to term it, appears to have been more ingenious than sound; and to have rested upon assumptions which, if generally admitted, would effectually do away with all medical evidence in cases of criminal abortion. The contents of the uterus were not produced, — a fact which left the case in mystery.

CONCEALMENT OF BIRTH.

CHAPTER 51.

MEDICAL EVIDENCE REQUIRED IN REFERENCE TO DELIVERY — CONCEALMENT OF THE BIRTH OF A CHILD—DEFINITION OF THE CRIME—FEMALES ACQUITTED OF INFANTICIDE FOUND GUILTY OF CONCEALMENT—MEDICAL EVIDENCE FROM THE REMAINS OF THE BODY — ANALYSIS OF BONES — THE CHILD MUST BE DEAD — CONCEALMENT OF THE OVUM OR EMBRYO — NOT NECESSARY TO PROVE WHEN THE CHILD DIED.

Concealment of birth.—Medical evidence respecting delivery is required in two cases: 1. when the birth of a child is wilfully concealed; and 2. when the contents of the uterus have been prematurely expelled by criminal means. The concealment of pregnancy is no offence in the English law: but the concealment of *delivery* or of *the birth* of a child is a misdemeanour by the 9th Geo. IV. c 31, sec. 14, the words of which are to the following effect:—

"Be it enacted, that if any woman shall be delivered of a child, and shall, by secret burying, or otherwise disposing of the *dead body* of the said child, endeavour to conceal the birth thereof, every such offender shall be guilty of a misdemeanour; and, being convicted thereof, shall be liable to be imprisoned with or without hard labour in the common gaol or house of correction for any term not exceeding two years: and it shall not be necessary to prove whether the child died before, at, or after its birth."

This is an offence of which those females who are charged with infanticide are most commonly convicted in England: while the Scotch law punishes females for the concealment of pregnancy, if the child be dead or amissing. (Alison's Criminal Law, p. 153.) The medical evidence on trials for this offence is exclusively derived from an examination of the mother; and thus, much will depend upon the time at which this is made. With respect to the child, its body need not even be produced, provided there is satisfactory evidence of its death: the body may have been secretly buried or otherwise disposed of. In the case of the *Queen* v. *Varney* (Oxford Lent Assizes, 1837), it was proved that the woman had been pregnant, and subsequently delivered of a child. Its body had been burnt, and only a few remains of the bones of a human fœtus were found in the ashes of a grate. The prisoner was convicted of the offence. In a case like this, in which an attempt has been made to destroy the body of a child by burning, it will, of course, be necessary to have good evidence that the bones are those of a *human fœtus* or child. (See INFANTICIDE, p. 412.) They may retain their shape whether burnt in a close fire or in the open air: in the latter case alone they will be white. A small fragment only of either end of any well-marked bone will suffice for identification. If the jaws be forthcoming, the alveolar cavities should be sought for, and the number and condition of the teeth noticed. The period of uterine life which the child had attained, may be thus in some instances determined. For two cases in which age and identity were thus determined, see Gazette des Hôpitaux, April 26, 1850.

If the body has been burned to a complete ash or powder, it will then be difficult to identify the bones. Orfila was consulted in a case of this kind, where a woman had burnt her child in an oven, and its ashes had become mixed with those of wood. He suggested, that on calcining the residue with potash, the ashes of a human fœtus might be known by their yielding cyanide of potassium, owing to the nitrogen which would remain in and about them. The ashes of wood do not yield the cyanide under similar circumstances. (Ann. d'Hyg. 1845, vol. 2. p. 129.) The conclusions drawn under such circumstances might, it appears to me, lead to a serious error: — the presence of a flannel dress, of an old hat, shoe, or any nitrogenous substance, would, on incineration, give rise to precisely similar results. When the *form* of a bone cannot be recognized, all that medical evidence can, as it appears to me, accomplish, is this: — The detection of a large quantity of *phosphate of lime* in the ash would indicate that bones were present, and thus distinguish the ash of bone from the ashes of other substances. Still the bones might have belonged to an animal, and not to a human fœtus. There are no means of distinguishing the ash of human, from that of animal bone, or the ash of fœtal from the ash of adult bones.

In *Reg.* v. *Berryman* (Guildford Summer Assizes, 1854), the prisoner was tried and acquitted on the charge of concealment of birth. She admitted that she had burnt the body of the child, and some calcined bones were produced, but these, it is reported, did not strictly correspond. The child was alleged to have been a seven months' child, but part of the skull produced corresponded to that of a nine months' child, or of one even older.

According to the statute, the child must be *dead* — the concealment of the birth of a living child not being any offence, unless it should happen to die before its birth was made known. In the case of the *Queen* v. *Woodman* (Kingston Lent Ass. 1845), the woman was acquitted because the child was living when concealed. Mr. Chitty says, that in order to constitute the offence, the child must have advanced to the end of the seventh month (Med. Jur. p. 412); but it is to be presumed that the concealment of the birth of a dead child at the sixth or under the seventh month, would be as much an infringement of the statute as if it were more advanced. The concealment of the aborted but undeveloped ovum — a monster, *i. e.* of a child without human shape, a mole or other morbid growth, would not probably be considered a contravention of the statute. I am not aware that there has been any judicial decision on this point. Mr. Lane communicated to the Medical Times (Aug. 1845) a case in which a charge of concealed birth was dismissed by the magistrates of Surrey, because the concealment referred to a child born at the eighth month *in its membranes.* The woman stated that she did not consider it to be a child! If this decision be correct, the main object of the statute (*i. e.* to prevent secret delivery, so often leading to murder) may be effectually evaded. The case, being entirely new, should have been sent for trial, and the decision left to the proper interpreters of the law. A magisterial decision can furnish no precedent on a question of this kind. This woman must have been delivered of a child, fœtus, or embryo, or of course there would have been no pretence for the charge. A singular case of alleged concealment of birth occurred at the Suffolk Lent Assizes, 1853. A married woman was charged with having concealed the birth of her infant child. It appeared that her husband and the neighbours supposed she was pregnant. After the child was reported to have been born, it was alleged that it had died, and preparations were accordingly made for the burial. The coffin was examined, and was found to contain not the body of a child but the figure of a doll. The learned judge directed the Grand Jury that before they could find a bill, charging the prisoner with the guilt of concealment, they must be satisfied (but of this there was no evidence on the depositions) that the woman had really been delivered of a *child*. The prisoner had been a married woman for a number of years, and her conduct could only be accounted for on the supposition that she had endeavoured to impose upon her husband and her neighbours. The case fell to the ground.

It will be perceived that it is not material here, as it is in a case of alleged infanticide, to prove *when* the child died—whether before, during, or after its birth; and thus those subtleties and technicalities which have been elsewhere pointed out in cases of infanticide are avoided. In regard to proof of concealment, and what constitutes it, these are essentially legal points:—but a medical practitioner may sometimes benefit an accused party, if he can prove that the female had made application to him on the subject of her pregnancy and delivery. The law is especially lenient under such circumstances. Questions connected with concealment of birth do not fall under the jurisdiction of a coroner:—the medical evidence is therefore required by a magistrate. Medical witnesses were formerly exposed to much trouble and inconvenience in giving their evidence on these occasions (see Med. Gaz. vol. 19. p. 287); but the defect has been remedied by a recent statute. (1 Vic. c 44.)

In a case under the Scotch statute in reference to the concealment of pregnancy, for a report of which I am indebted to an eminent legal authority, a curious question arose, viz. "Whether the charge was excluded if the woman, an unmarried female, proved that she had intimated that she was with child to the father, but denied the pregnancy to every one else. That the object of the statute was defeated in such a case, and yet that the main fact on which the statutory offence is founded was proved, could not be doubted. Concealment, and not calling and making use of assistance in the birth, constitute the offence. The Court of Judiciary was nearly equally divided. The majority went on the bare terms of the statute: the minority held that concealment was here a general term to denote the denial to all near and around the woman, and from whom assistance might be obtained, and was coupled with not calling for assistance in the birth. As a letter written to Australia, if the father had gone there, could not be taken to exclude the statutory offence, and as the woman concealed her pregnancy and had obtained no assistance in the birth, an expression which shows what the character of the concealment referred to is, the communication of the fact of pregnancy to the father of an illegitimate child (often more anxious to get rid of the child than the mother) really could not lead to its preservation, and left the concealment which the statute referred to equally complete. But the point was not actually decided, as it was thought that the terms of the special verdict did not raise the question, but by an accidental form of expression, excluded it."

CRIMINAL ABORTION.

CHAPTER 52.

GENERAL REMARKS ON THE CRIME OF ABORTION — ABORTION FROM NATURAL CAUSES — ITS FREQUENCY. CRIMINAL CAUSES — LOCAL VIOLENCE — ABORTION BY MECHANICAL MEANS — FROM VENESECTION — MEDICINAL SUBSTANCES — POPULAR ABORTIVES—SIGNS OF ABORTION IN THE FEMALE —SPECIFIC ABORTIVES—ABORTION NOT ALWAYS A RESULT OF POISONING—LOCAL APPLICATIONS. FEIGNED ABORTION—LEGAL RELATION — MEANING OF THE WORD NOXIOUS AS APPLIED TO DRUGS—ON INDUCING PREMATURE LABOUR—MEDICAL RESPONSIBILITY — PROOF OF PREGNANCY NOT NECESSARY — ABORTION OF MONSTERS — EXTRA-UTERINE CONCEPTIONS—ABORTION OF MOLES AND HYDATIDS. CHEMICAL EVIDENCE—ANALYSIS OF THE BLOOD OF ABORTION AND OF THE LIQUOR AMNII.

General remarks.—By abortion is commonly understood, in medicine, the expulsion of the contents of the uterus *before the sixth month of gestation.* If the expulsion take place between the sixth and ninth month, the woman is said to have a premature labour. The law makes no distinction of this kind, but the term abortion is applied to the expulsion of the fœtus at *any period of pregnancy* before the term of gestation is completed; and in this sense it is synonymous with the popular term *miscarriage.* Criminal abortion is rarely attempted before the third month: — it is perhaps most common between the fourth and fifth month: because then a female begins for the first time to acquire a certainty of her pregnancy. The causes of abortion may be either *natural* or *violent.* The latter only fall under the cognizance of the law: — but a medical witness should be well acquainted with the causes which are called natural, in contradistinction to others which depend on the application of violence. These *natural* causes are so frequent, that, according to Mr. Whitehead's observation,—of 2000 pregnancies, one in seven terminated in abortion. These causes are commonly ascribable to peculiarities in the female system,—to the presence of uterine or other diseases, or to some moral shock sustained by a woman during pregnancy. Any diseases which strongly affect the uterus or general system of the female may give rise to abortion. An attack of small-pox has been known to produce it; and it has been suggested by Mr. Acton, that the presence of constitutional syphilis in the father is not only a cause of infection in the offspring, but of repeated abortion in the female. (Med. Gaz. vol. 36. p. 164; Ramsbotham's Obstetric Medicine, p. 655.) These facts deserve attention, when it is proved that a woman has really aborted, and an attempt is unjustly made to fix an alleged act of criminality on another. For further information on the numerous natural and accidental causes which may give rise to abortion, the reader may consult the work of Mr. Whitehead (On Abortion and Sterility, p. 252. Also, for the effects of undue lactation and disease of the placenta, see Med. Times and Gaz., Dec. 4, 1852, p. 580, and March 19, 1853, p. 302.) In considering the operation of these causes, it is proper to bear in mind that during pregnancy the uterus is considered to be subject to a natural periodical excitement, corresponding to what would have been the menstrual periods dating from the last cessation. Hence comparatively trivial causes operating at these periods may lead to an expulsion of the fœtus.

The *violent* causes of abortion may be of an accidental or criminal nature. In general, the distinction will not be difficult:—the kind of violence, and the adequacy of the alleged cause to produce abortion, will be apparent from the evidence. The causes of abortion in criminal cases may be referred either, 1, to the use of *mechanical* means, or 2, of irritating *medicinal* substances acting upon the uterus or bowels. These causes operate with greater certainty just in proportion as the pregnancy is advanced.

Mechanical means.—Among the mechanical causes may be mentioned—undue exercise, the violent agitation of the body, as by riding or driving over a rough pavement, in which case no marks of violence would be apparent. Any physical shock, sustained by the body, may operate indirectly on the uterus. Blows or violent pressure on the abdomen are sometimes resorted to; but in these cases the marks of violence will be commonly perceptible. Instruments have been devised for the purpose of piercing the membranes, destroying the child, and thereby leading to its expulsion. Devergie speaks of such instruments being well known in England, and of English midwives deriving a living from the practice of this crime (vol. 1. p. 285.) Although this must be regarded as an exaggerated statement, it cannot be denied that cases have transpired which show that the crime is frequently perpetrated by persons who basely derive a profit from the practice: and for one case that comes to light probably a dozen are effectually concealed. In the evidence given on four trials, within a recent period, the cases presented no feature of novelty or interest. Instruments were employed, and drugs in large doses were proved to have been administered.

Mechanical means are undoubtedly more effectual in producing abortion than medicinal substances; yet from the fact of such attempts being made by ignorant persons, the woman generally dies from hysteritis, peritonitis, or other serious after-consequences. A case was tried some years since, in which the evidence showed that the prisoner had attempted to produce abortion in the deceased, by thrusting wooden skewers into the substance of the uterus. Inflammation and gangrene took place, and the woman died. The prisoner was convicted, and executed for murder. (For a similar case by Mr. M'Pherson, see Med. Gaz., vol. 36. p. 102. See also a case in the same journal, vol. 45. page 693.) This kind of injury to the uterus always implies the interference of some other person in the perpetration of the crime. These mechanical means can seldom be applied to the uterus, without leaving marks of violence on this organ, as well as on the body of the child. If the mother die, a result which generally takes place, an inspection will at once settle the point. (Ann. d'Hyg. 1834, 191; 1838, vol. 1. p. 425; 1839, vol. 2. p. 109.) An important case of this kind was the subject of a criminal trial in Scotland in 1858 (Case of *Reid*, Medical Gazette, December 11, 1858). The uterus near its mouth presented two openings in its substance, described as punctured wounds by the witnesses who made the examination; but as the openings of torn blood-vessels by others who were called for the defence. There was also a rupture of one ovary. The prisoner was convicted; but the medical man who was supposed to have been the principal agent in the crime, committed suicide. The case is chiefly important in showing that any apparent mechanical injury to the uterus should be minutely examined, so that no doubt of the cause may afterwards be entertained. If, in a case of this kind, the mother survive and the child be expelled, then marks of violence will be found on its body. These marks may not be sufficient to account for its death; but this is not here the question. If it can be proved that they have not resulted from accidental causes during gestation or subsequently to delivery, then their presence may furnish strong corroborative evidence of the actual means by which abortion was attempted. It is said that abortion has been in some instances accomplished by frequent venesection. This effect may follow from the violent shock produced by the loss of a large quantity of blood. An examination of the veins of the arms would show whether any such attempt had been made.

There can be no doubt that of all the exciting causes of abortion, the most effectual, and that which most certainly brings on the expulsive action of the uterus, is the destruction of the ovum or embryo. If by accident or design the ovular membranes should become ruptured, gestation is arrested, and abortion necessarily ensues. At any period of pregnancy, therefore, a puncture through the membranes will sooner or later occasion the evacuation of the uterus (Ramsbotham's Obstetric Medicine, p. 655.) This author remarks that the performance of the operation demands a most accurate knowledge of the anatomy of the ovum and the maternal structures, as well as of the state of development which the neck of the uterus assumes at different periods of pregnancy. In medical practice for the induction of premature labour, the membranes are ruptured either by the use of a female catheter, or by an instrument of this shape, but including a blade like a tonsil-lancet. Unless the inner membrane or amnion be opened, gestation may still proceed, and abortion will not take place. When the membranes are completely penetrated, and the waters are discharged, uterine action is invariably induced, but the time which elapses from the performance of the operation to the commencement of labour is subject to great variation. Dr. Ramsbotham states that he has known the uterus begin to act in *ten hours*, but in another case a week elapsed before its action commenced. As a general rule, uterine action is fully established in fifty or sixty hours. It must not be supposed, however, that where criminal intention exists, so long a period is required for removing the contents of the uterus. The cases above referred to were cases of obstetric practice, in which there was no desire to expose the female to the slightest risk, and premature labour was induced openly. In a criminal attempt by a medical practitioner, in which the woman would be a consenting party to the act, the removal of the embryo or fœtus might be effected in a much shorter period of time. At any rate, the time for the completion of abortion could not be measured by cases in which the uterus has been left to undergo spontaneous contraction after the membranes had been punctured, and the waters had escaped. There would, however, be great danger to a female in the necessary manipulations required.

It is obvious that this mode of perpetrating abortion is only likely to succeed in the hands of persons who have a complete anatomical knowledge of the parts. The certain death of the female will convert the crime to murder, when instruments are introduced into her body by persons who are ignorant of anatomy. It is to be regretted that members of the medical profession have on several occasions misused their professional knowledge, and have exposed themselves to criminal prosecutions for this offence. Sometimes it is probable the charge has been raised falsely, or through misapprehension on the part of the female; at others the evidence has left it very clear that the charge was well-founded. Of late years medical men have rather freely used the speculum. When this instrument has been improperly or unnecessarily used on a pregnant female, a charge of attempted abortion by instruments may be easily raised against a medical practitioner. A trial took place at the Exeter Lent Assizes, 1854 (*Reg.* v. *Griffin and Venn*), in which it was charged that the accused, Venn (a surgeon), had feloniously used an instrument with the intent to procure the miscarriage of the prosecutrix. According to the evidence, Venn had on several occasions passed a round polished instrument into the body of the woman, once in a coppice and at another time in a field. The defence was, that the surgeon had merely used a speculum to ascertain whether the girl was pregnant, in order to know how to prescribe for her; and it was absurd to suppose that he had ever intended to procure abortion, for this had not followed, and it might have been easily produced by him at any period of pregnancy if prisoner had wished it. The prisoners were acquitted. Admitting the statements of the prosecutrix and prisoner to be correct, it may be remarked that medical practitioners, in the lawful exercise of their profession do not commonly use a speculum in open fields or coppices to determine whether a female is pregnant or not: and it is a well-known fact that a speculum is not required for determining the question of pregnancy at all. This case conveys a serious caution to members of the medical profession.

Medicinal substances.—These are perhaps more frequently resorted to for inducing criminal abortion than other means; but they rarely answer the intended purpose, and when this result is obtained, it is generally at the expense of the life of the mother. Mineral poisons have been ignorantly employed for this nefarious object: as arsenic, corrosive sublimate, sulphate of copper, muriate of iron (*Reg.* v. *Wright*, Abingdon Autumn Ass., 1855), and other irritants. Croton oil, gamboge, colocynth, aloes (Henke, Zeitschrift, 1844, vol. 2, p. 203), hiera picra (see *ante*, p. 167), elaterium, and other drastic purgatives, have also been used for a similar purpose. Purgatives which produce much straining, and powerful emetics or diuretics, will readily excite abortion in these advanced stages of pregnancy: but these violent medicines fail in their effect at the earlier stages. A decoction of fern or of broom tops has been sometimes used. The decoction of broom is a strong diuretic. In the case of *Reg.* v. *Morris* (Reading Lent Ass., 1858), a decoction of fern was used. It merely produced sickness. The substances just mentioned exert an indirect action on the uterus by producing a shock to the general system:—but there is a certain class of bodies called emmenagogues, which have a specific action on the uterus itself. Among these, the Ergot of rye, or Secale cornutum, may be particularly noticed. Other vegetable, animal, and mineral substances, which may be enumerated as having acquired popular repute for procuring abortion, are savin, cantharides, rue, iron filings, squills, grains of paradise (*Reg.* v. *Rushforth*, York, Autumn Ass., 1857), pennyroyal, black hellebore, and tansy. In April, 1856, a medical man was convicted before the Central Criminal Court of Sydney, of administering extract of belladonna in a suppository, with a view to procure abortion. In a case which occurred in France iodide of potassium was pronounced by three medical men to be an abortive (Med. Times and Gaz., Jan. 29, 1859), but the grounds for this opinion are not given. None of these substances have any influence on the uterus, except in affecting it indirectly by their irritant action on the system. (For an account of the poisonous properties of Savin, see *ante*, p. 168.) In the Coroners' return for 1837-8, there were four cases of the administration of savin and other drugs with the view of procuring abortion. In three of these cases, the mother died undelivered; in the fourth, the child perished.

Specific abortives. Ergot of Rye, or Secale cornutum.—This substance has been found, in many instances, to bring on violent action of the uterus at an advanced stage of gestation, or when efforts at parturition had already commenced. There is, however, considerable difference of opinion respecting its emmenagogue properties. According to Dr. Lee, it has no effect, at least in the *early* stages of gestation, although given in very large doses. (Med. Gaz. vol. 25. p. 10; see also Ed. Med. and Surg. Jour. vol. 53. p. 27.) Dr. Kluge, of Berlin, found that its properties varied according to whether it was gathered before or after harvest;—in the former case it had an energetic action, while in the latter it was powerless. The properties of the secale are but little known to the vulgar in this country; and this may account for the fact of our rarely hearing of cases in which it has been criminally administered to pregnant females. Dr. Beatty states that when used in obstetric practice it is liable, by absorption into the system of the mother, which may take place within two hours, to endanger the life of the child. (Dub. Med. Jour., May, 1844, p. 202.) This question was actually referred by the French Government to the Academy of Medicine in 1845, as there was reason to think that under its employment in the practice of midwifery children were frequently born dead. (Ann. d'Hyg., 1846, vol. 1. p. 204. See also Med. Gaz. vol. 46. p. 680.) In confirmation of Dr. Beatty's statement, Drs. M'Clintock and Hardy report, that, out of thirty cases in which it was administered, twenty children were born dead. (Practical Observations, p. 95.) Dr. Ramsbotham considers that the drug may operate fatally on a child according to the circumstances under which it is administered: but that, unless it excites the expulsive action of the uterus, it has no effect on the child's system. (Op. cit. p. 319.) According to M. Millet, in commenced or imminent abortion, ergot procures a safe and prompt termination. He has never met with a case in which it has injured the child. (Med. Chir. Rev., July 1855, p. 41.) On trials for criminal abortion perpetrated or attempted, a medical witness must therefore be prepared for a close examination on the specific emmenagogue properties of this drug. A case, which occurred a few years since (*Reg.* v. *Calder*, Exeter Lent Assizes, 1844), has been reported, with comments on this subject, by Dr. Shapter (Prov. Med. Journal, April 10, 1844). It was alleged on this occasion, that savin, cantharides, and ergot had been respectively given by the prisoner, a medical man, for the purpose of procuring miscarriage. The prosecutrix was a woman of notoriously bad character, and the prisoner was acquitted. There were three medical witnesses, who agreed that savin and cantharides were only likely to occasion abortion indirectly, *i.e.* by powerfully affecting the system—the view commonly entertained by professional men. Some difference of opinion existed with regard to *Ergot.* Dr. Shapter stated, in his evidence, that he did not think the ergot would act unless the natural action of the uterus had already commenced,—a statement supported by a number of authorities. Subsequently to the trial, he collected the observations of many obstetric writers, and so far modified his opinion as to admit that the ergot might *occasionally* exert a specific action on the uterus, in cases of advanced pregnancy, even when uterine action had *not* already commenced. His summary on this subject is one of the best which has been published. Dr. Ramsbotham has reported three cases from which it would appear that the ergot may in some instances exert a direct action on the impregnated and quiescent uterus. In these instances, the females were in or about the *eighth* month of pregnancy. (Med. Gaz. vol. 14, p. 434.) This observation has been fully confirmed by further experience on the use of the drug (Med. Times and Gaz., Jan. 7, 1854, p. 8. See also his obstetric Med. and Surg., p. 198.) Dr. J. H. Davis believes that it is a specific excitant of uterine action, and points out the cases in which, in his opinion, it may be safely employed. (Lancet, Oct. 11, 1845, p. 393.) In a case in which, owing to distortion of the pelvis it was necessary to bring on labour six weeks before the full period, Mr. Raynes found that ergot in the form of infusion in repeated doses excited the action of the uterus, and delivery was accomplished within fifty-eight hours of the taking of the first dose. The uterus was in a quiescent state before the medicine was given to the patient. (Med. Times and Gaz., March 14, 1857, p. 260.) Mr. Whitehead, who has had considerable experience on this subject, has found that its action is very uncertain. In a case under his care, that of a woman with deformed pelvis, it was considered advisable to procure abortion in the fifth month of pregnancy; the ergot alone was employed, and at first with the desired effect. It was given in three successive pregnancies; and in each instance labour-pains came on after eight or ten doses had been administered, and expulsion was effected by the end of the third day. It was perseveringly tried in a fourth pregnancy in the same female, and failed completely. (On Abortion, 254.) It also failed in a case in the hands of Dr. Oldham. (Med. Gaz. vol. 44. p. 49.) Nevertheless, the balance of evidence is decidedly in favour of its specific action, as a direct uterine excitant; and, according to Dr. Griffiths, this is so well known to the inhabitants of the United States, that it is there in frequent use as a popular abortive. Perhaps the differences which have been observed in its action may have depended on the quality of the drug as well as on the period at which it was administered. Admitting that the uterus is subject to periodical excitement, corresponding to the menstrual periods, it is probable that the action of ergot may be more powerfully abortive at these than at other times. In a case in which I was consulted in 1860, an attempt had been made to administer secretly the ethereal tincture of ergot. The reader will find a large collection of cases, illustrating the properties of this drug, in Wibmer (Arzneimittel und Gifte, vol. 2. p. 80: *Sphacelia segetum*. See also Pereira, Mat. Med. vol. 2. part 1. p. 102.)

The form and characters of the ergot in mass are too well known to professional men to require description. It is black on the outside and reddish-white within, having a soft rough fracture. When the powder is rubbed with a solution of potash it evolves a fishy odour, and the solution acquires a dingy red colour. In the form of tincture, alcoholic or ethereal, the only test is the odour of the extract when treated with potash. This may, however, be concealed by other odours. Sometimes small particles of ergot presenting a pink red colour, and a dark external coat may be detected in the sediment by the microscope.

Savin. Oil of Savin.—This vegetable substance possesses great popular repute as an abortive. In a case which I was required to investigate in 1845, it was a question whether savin, which had been taken in the state of powdered leaves, and had caused the death of a woman, exerted any specific action on the uterus to induce labour. The reply was given, that, in large doses, it acted only indirectly as an abortive by its irritant properties. (See Med. Gaz. vol. 36. p. 646.) It is proper to remember, that the infusion is more powerful than the decoction; since the poison, being a volatile oil, is dissipated by long boiling. Savin is, however, commonly taken or administered in the form of powder (p. 168). In a case tried at the Cornwall Lent Assizes, 1852 (*Reg.* v. *Pascoe*), the accused, a medical man, was convicted and sentenced to transportation for administering *oil of savin* to a female with intent to procure miscarriage. The proof of intent rested partly on medical and partly on moral circumstances. It appeared that the prisoner had given fourteen drops of the oil, divided into three doses, daily—a quantity which, according to the medical evidence at the trial, was greater than should have been prescribed for any lawful purpose. The medicinal dose, as an emmenagogue, on the authority of Christison, is from two to five *minims*, and, according to Pereira, from two to six *drops*. The quantity given by the prisoner, although a full dose, was not, therefore, greater than these authorities recommend; and his criminality appears to have rested not so much on the dose given, as on the question whether he knew, or as a medical man, had reason to *suspect*, that the female for whom he prescribed it, was pregnant. No medical authority would recommend oil of savin in full doses for *pregnant* females; and with regard to the existence or non-existence of pregnancy in a special case, medical men are reasonably presumed to have better means of satisfying themselves than non-professional persons. The prisoner's innocence, therefore, rested on the presumption that he implicitly believed what the prosecutrix told him regarding her condition,—that he had no reason to *suspect* her pregnancy, and therefore did not hesitate to select and prescribe a medicine which certainly has an evil reputation, and is rarely used by practitioners. According to the evidence of the prosecutrix, she informed the prisoner that she had disease of the heart and liver, and that nothing more was the matter with her. It is absurd to suppose that oil of savin would be prescribed by a medical man for such a disease as this. The prisoner, on the hypothesis of innocence, must have intended the medicine to act on the uterus, and must have inferred the existence of an obstruction of menstruation from natural causes irrespective of pregnancy. The jury do not appear to have given him credit for such ignorance of his profession, and this probably led to his conviction. There can, it appears to me, be no doubt that the oil was administered with guilty intention. Every qualified practitioner would undoubtedly satisfy himself that a young female, whose menses were obstructed, was *not pregnant*, before he prescribed full doses of this oil three times a day, or he would fairly lay himself open to a suspicion of criminality. If pregnancy—a frequent cause of obstructed menstruation—were only *suspected*, this would be sufficient to deter a practitioner of common prudence from prescribing, in any dose, a drug which may exert a serious action on the uterine system. (A report of the case of Mr. Pascoe will be found in the Med. Times and Gazette, April 17, 1852, p. 404.)

The oil of savin is obtained by the distillation of the tops in the proportion of about three per cent. by weight. It has a yellowish colour, and the peculiar terebinthinate odour of the plant, by which alone it may be recognised. It may be separated from the contents of the stomach by agitating them in a bottle with its volume of ether, in which the oil is very soluble. The ether may be afterwards removed by distillation. The oil of savin forms a turbid mixture with alcohol (·826). When treated with its volume of sulphuric acid, it acquires a dark-brown colour, and when this mixture is added to distilled water, a dense white precipitate is separated. The odour is the best test.

Oil of tansy.—Dr. Hartshorne, the American editor of this work, states that in the United States the *oil of tansy* (*Tanacetum vulgare*) has acquired the character of a popular abortive, and has caused death in several instances. In England this oil and the herb have been chiefly employed for the purpose of expelling worms. Dr. Pereira quotes a case in which half an ounce of the oil proved fatal. The symptoms were spasms, with convulsive movements and impeded respiration. No inflammation of the stomach or bowels was discovered upon dissection. (Mat. Med. vol. 2. pt. 2. p. 26.) The cases referred to by Dr. Hartshorne, are, 1. A tea-spoonful of the volatile oil was taken by a girl in mistake for the essence. She complained of giddiness, and became insensible in ten minutes. Convulsions came on, with frothing at the mouth, difficult respiration, and irregular pulse, and she died in one hour after taking the oil (Amer. Jour. Med. Sci. July, 1852, p. 279.) 2. The second case occurred to Dr. Dalton, and is reported by him in the same journal for January 1852, p. 136. A healthy-looking girl, æt. 21, took eleven drachms of oil of tansy about six hours after a hearty dinner. She was found insensible and in convulsions, soon after she must have taken the drug. She died in three hours and a half. A strong odour of tansy was observed in the breath before death, and on inspection in the peritoneal cavity, stomach, and even the interior of the heart. The uterus contained a well-formed fœtus about four months old, which did not, either in itself or its membranes, present any evidence of having been disturbed. 3. In a third case, (reported in Amer. Jour. Med. Sci. for May 1835,) a woman but a few weeks pregnant took half an ounce of the oil, and did not entirely lose her consciousness until three quarters of an hour had elapsed, although she was convulsed at intervals before that time. She died without abortion being produced, within two hours after taking the poison. These facts show, that while oil of tansy possesses no specific action on the uterus as an abortive, and does not even affect this organ or its contents by sympathy, it is capable of acting as a powerful poison on the brain and nervous system, and of destroying life rapidly. The oil would be easily recognised either before or after distillation of the contents of the stomach, by its peculiar and penetrating odour. It is very soluble in ether, and this may be employed for its separation.

It is remarkable, that the action of the most powerful mineral irritant poisons have sometimes failed to affect the gravid uterus. In July 1845, a case was referred to me for examination by Mr. T. Carter, of Newbury, in which a female, aged twenty-two years, who had passed the fifth month of pregnancy, took a large dose of arsenic, and died in less than seven hours, having suffered from severe vomiting and purging during that time: yet abortion did not take place! In reference to the medicinal use of mercury, it may be proper to state, that Dr. Salomon has reported two cases, in which premature delivery appeared to follow the mercurialization of the system. (Casper's Wochenschrift, June 1845; Med. Gaz. vol. 36, p. 658.)

Local applications.—In a case which occurred in France, it was proved that abortion had been caused by the injection of some corrosive and irritating substance into the vagina. The female genitals, as well as the abdominal viscera, were found in a high state of inflammation. (Med. Gaz. vol. 37, p. 171.) This is an unusual mode of perpetrating the crime; but it is one which can hardly escape detection. An analysis of the tissues might be required, in order to determine the nature of the substance used. It appears from a trial which took place at the York Summer Assizes, 1853, that this mode of attempting to produce criminal abortion has been the subject of a prosecution in this country. It was established by the evidence that some liquid was injected into the vagina by a syringe; but there was no proof of the nature of this liquid, and as it was not proved that it was of a *noxious* nature, the learned judge who tried the case directed an acquittal. (Lancet, July 23, 1853, p. 89.)

Signs of abortion in the living and dead.—These have been already considered in a previous chapter. (See DELIVERY, *ante*, pp. 551 and 553.) The examination may extend to the female either living or dead. In the former case, there will be some difficulty if the abortion has occurred at an early period of gestation, and several days have elapsed before the examination is made. In the latter case the investigation is not always free from difficulty. One fact here requires to be especially noticed. It is now believed by many physiologists, that menstruation is a state, in some measure, vicarious to conception; and the appearances presented by the generative organs during the menstrual period, are somewhat similar to those which are observed after conception in its early stage. Mr. Whitehead remarks, that in persons who have died while the menses were flowing, the uterine walls were thickened and spongy; and the mucous lining was more or less turgid and suffused. The cervix and labia of the uterus were tumid, the orifice open, and the vaginal membrane and clitoris involved in the increased action. One of the ovaries was found larger and more congested than ordinary, presenting evidences of the recent escape of an ovum. (On Abortion, p. 196.) Unless these facts are attended to, an examiner may form an erroneous opinion respecting the chastity of a deceased female.

Feigned abortion.—For various motives, into the consideration of which it is unnecessary to enter, a woman may charge another with having attempted or perpetrated the crime of abortion. Such a charge is not common, because, if untrue, its falsity is easily demonstrated. A young woman, admitted into Guy's Hospital in April 1846, charged a policeman, who, according to her statement, had had forcible intercourse with her, with having given her some substance to produce abortion, and with having subsequently effected this mechanically. She was not examined until nearly two months after the alleged perpetration of the crime, when the late Dr. Lever found that there was no reason to believe she had ever been pregnant. This was a case of feigned abortion. When charges of this serious kind are brought forward, they are always open to the greatest suspicion, unless made immediately after the alleged attempt, as it is then only that an examination can determine whether they be true or false. If so long delayed, as in this instance, without any satisfactory reason, the presumption is that they are false.

Legal relations.—The English law relative to criminal abortion is laid down in the statute 1 Vict. c. lxxxv. s. 6. By it, capital punishment, which formerly depended on the proof whether the female had quickened or not, is abolished. The words of the statute are as follows:—

"Whosoever, with the intent to procure the miscarriage of any woman, shall unlawfully administer to her, or cause to be taken by her, any poison or other *noxious thing*, or shall unlawfully use any instrument or other means whatsoever, with the like intent, shall be guilty of felony, and being convicted thereof, shall be liable, at the discretion of the Court, to be transported beyond the seas for the term of his or her natural life, or for any term, not less than fifteen years, or to be imprisoned for any term not exceeding three years."

It has not been decided whether, under this statute, a woman could be tried for abortion attempted *on herself*. The consent, or even the solicitation of the female to the perpetration of the crime, does not excuse an offender. The crime would never be attempted without the consent of a woman; and, therefore, to admit this consent as a sufficient justification, would be equal to an entire abrogation of the law. The *means* must have been used with an *intent* to procure the miscarriage of the woman, — a point which will be sufficiently established by a plain medical statement of the means employed. Supposing that a drug has been used, the witness will have to state whether it is "a poison, or other *noxious* thing;" for this must be proved in order that the prisoner should be convicted of the crime. I must refer the reader to what has been said elsewhere (*ante*, p. 2), in order that he may be able to judge how far the substance administered would fall under the description above given. Whether the substance would or would not have the effect intended, *i. e.* of inducing abortion, is perfectly immaterial. Some uncertainty may exist as to the strict meaning of the word *noxious*: — all will allow that the word implies something injurious to the system: but a difference of opinion may arise among witnesses with respect to its application to the substance under discussion,— as, for example, with respect to rue or savin. A substance must be regarded as injurious to the system, or noxious, either according to the form, quantity, or frequency with which it is administered. Savin and rue are irritant; and become noxious when given in large doses, or in small doses frequently repeated. (Ann. d'Hyg. 1838, vol. 2. p. 180.) Aloes and castor-oil are innocent when taken in small doses; but they acquire noxious or injurious properties when administered frequently, or in large quantity, to a pregnant female. To confine the term noxious, therefore, to what is strictly speaking a poison *per se*, would be giving a latitude to attempts at criminal abortion, which would render the law inoperative. (See the case of *Reg.* v. *Stroud*, Abingdon Sum. Ass. 1846.) The small quantity of the substance taken at once does not affect the question, provided the dose be frequently repeated. A case in which I was consulted by Mr. Reynolds (a former pupil) was tried at the Exeter Winter Assizes, 1844. Two powders, weighing each one drachm, were prescribed by the prisoner,— one consisted of colocynth, the other of gamboge, and with them was half an ounce of a liquid (balsam of copaiba). They were to be mixed together, and a fourth part to be taken four mornings following. Mr. Reynolds said, in answer to the question whether such a mixture was noxious or injurious, that each dose would be an active purgative, and might thereby tend to produce abortion. One dose would not be productive of mischief in a healthy countrywoman, but its frequent repetition might lead to serious consequences. In a trial which took place at the Norwich Lent Assizes, 1846 (*Reg.* v. *Whisker*), it was proved that the prisoner had caused to be taken, by the prosecutrix, a quantity of *white hellebore*, in powder, for the purpose of procuring abortion. One medical witness said he considered hellebore to be noxious to the system, but he knew of no case in which it had produced death; and under these circumstances he did not consider himself justified in calling it a poison. Another medical witness stated that in his opinion it belonged to the class of poisons. The judge, in summing up, told the jury that *that* was to be regarded as a poisonous drug which, in common parlance, was generally understood and taken to be such; and he thought the evidence sufficiently strong to bring hellebore within the meaning of the statute. The jury found the prisoner guilty, alleging in their belief white hellebore was a poison. (Med. Gaz. vol. 37. p. 830.) The only circumstance calling for remark in this case is, that any doubt should have been entertained by a medical practitioner respecting the poisonous properties of white hellebore. It is a powerful vegetable irritant, and has caused death in several instances; yet on this occasion it appears to have been admitted to be *noxious*, but not *poisonous!* The nature of the substance administered, and that it is *noxious*, should be proved. No speculative evidence is favourably received when some portion of the substance cannot be procured. In *Reg.* v. *Taylor* (Exeter Winter Ass. 1859) some powders had been given by the prisoner to a girl with the view of inducing abortion. No portion of the powders could be obtained for examination: but two medical gentlemen who heard the evidence gave their opinion that the powders were of a noxious nature. In the defence, it was urged that this had not been proved. The jury adopted this view, and returned a verdict of acquittal.

In reference to the proof of this crime, it is not required, under the circumstances, that any specific injury should have been done to the woman, or that abortion should have followed in order to complete the offence. There is every reason to believe that the crime is frequent; but its perpetration is secret. Applications are continually made to druggists by the lower class of people for drugs for this purpose: the applicants appear to have no idea of the criminality of the act. (See, in reference to the frequency of this crime, a paper in the Medical Gazette, vol. 46. p. 487; also Med. Times and Gaz. Nov. 21, 1857, pp. 524, 537.)

On inducing premature labour. Medical responsibility.—It may be proper to offer here a few remarks upon the practice of inducing *premature labour*, which is adopted by some members of the profession, in cases in which there happens to be great deformity of the female pelvis. This practice has been condemned as immoral and illegal; but it is impossible to admit that there can be any immorality in performing an operation to give a chance of saving the life of a woman, when, by neglecting to perform it, it is almost certain that both herself and the child will perish. (See, on the morality, safety, and utility of the practice, Ramsbotham's Obstet. Med. p. 315.) The question respecting its illegality cannot be entertained; for the means are administered or applied with the *bonâ fide* hope of benefiting the female, and not with any criminal design. It is true that the law makes no exception in favour of medical men who adopt this practice, nor does it in the statute of wounding make any exceptions in favour of surgical operations; but that which is performed without evil intention, would not be held to be unlawful. The necessity for the practice ought to be apparent; — thus, for instance, it should be shown that delivery was not likely to take place naturally, without seriously endangering the life of a woman. It is questionable whether, under any circumstances, it would be justifiable to bring on premature expulsion, merely for the purpose of attempting to save the life of a child, since the operation is necessarily accompanied with risk to the life of the mother. The grounds upon which many eminent authorities have objected to this practice, are: — 1. That there are few cases in which parturition, if left to itself, might not take place at the full period. 2. The toleration of the practice would lead to great criminal abuse. 3. It is attended with danger to the mother and child. It is undoubtedly true, that parturition will sometimes take place safely at the full time, even when the deformity of the pelvis is apparently so great, as to lead many accoucheurs to suppose natural delivery to be utterly impossible. Dr. Lilburn has reported the case of a female who laboured under great deformity of the pelvis, but who was twice delivered in safety, and the child survived. (Med. Gaz. vol. 19. p. 933.) It is, therefore, not improbable that many cases of the kind are prematurely treated, which, if left to themselves, would probably do well without interference. Hence a cautious selection should be made; because the operation is necessarily attended with some risk, — it does not insure safety to the woman and child. All that we can say is, that, according to general professional experience, it places her in a better position than she would be in, if the case were left to itself. It appears to me that before a practitioner resolves upon performing an operation of this kind he should hold a consultation with others: and, before it is performed, he should feel well assured that delivery cannot take place without greater risk to the life of the mother, than the operation itself would create. These rules may not be observed in practice: but the non-observance of them is necessarily attended with some responsibility to a practitioner. In the event of the death of the mother or child, he exposes himself to a prosecution for a criminal offence, from the imputation of which even an acquittal will not always clear him in the eyes of the public. If the child were born alive, and died merely as a result of its immaturity, this might give rise to a charge of manslaughter. Within a recent period several practitioners have been tried upon charges of criminal abortion,—whether justly or unjustly it is not necessary to consider; but they had obviously neglected to adopt those simple measures of prudence, the observance of which would have been at once an answer to a criminal charge. Because one practitioner may have frequently and successfully induced premature labour, without observing these rules, and without any imputation on his character, this cannot shield another who may be less fortunate. A charge is only likely to arise when a man has been unfortunate; and the responsibility of one operator cannot be measured by the success of others.

A case occurred at Portsmouth in 1848, in which a female died from loss of blood, which took place during an attempt to induce premature labour. A small aperture was discovered after death in the left common iliac artery, and more than a pound of blood had been effused. This was ascribed to a thinning of the coats of the artery, and not to a puncture of the vessel during the operation. (See Lancet, July 22, 1848, p. 107.) For some judicious remarks on the induction of premature labour, by Dr. Radford, see Med. Gaz. vol. 47. p. 583.

Is proof of pregnancy necessary.—A female may imagine that she is pregnant, when she is labouring under ovarian dropsy, or other uterine or abdominal disease. Under this mistaken view, an attempt may be made by another, also deceived as to her condition, to procure abortion: and the proof of the corpus delicti will rest here upon the medical evidence. The *pregnancy* of the female is not alluded to in the statute. The words are as follows:—"procure the miscarriage of any woman." These might at first sight appear to include the state of pregnancy; but the term "miscarriage" has a much more extensive meaning than this in a popular sense. The question in reference to the necessity of the proof of pregnancy has been hitherto variously decided by our judges. A case was tried on the Midland Circuit, July 1838, in which a medical practitioner was charged with this crime. Chief Justice Tindal held, that without positive proof of the woman's pregnancy, which, however, was distinctly alleged in the indictment, a conviction could not take place. In this instance, the woman herself denied her pregnancy, and there was no evidence in support of it. The judge directed an acquittal. On the Spring Circuit of the same year, a man was tried at Lincoln, on a charge of administering a certain noxious drug to a female, with the intent to procure a miscarriage. The jury stated their opinion, that the girl was not pregnant when she took the drug. In this case the prisoner was discharged. More recently, in the case of *Reg.* v. *Haynes* (Cent. Crim. Court, 1843), the prisoner was found guilty of administering a drug with intent to procure abortion, when the woman was clearly proved, by the dissection of her body, *not* to have been *pregnant.*

The question whether the state of pregnancy is or is not an essential condition in reference to charges of criminal abortion has, however, been decided in the negative, on a conference of the judges, in the case of the *Queen* v. *Goodall* (Notts Lent Ass. 1846). The deceased, believing herself to be pregnant, applied to the prisoner to procure abortion by puncturing the membranes. Some instrument was used for this purpose: and deceased, who had laboured under chronic cough, died, as it was alleged, from the maltreatment of the prisoner. The body was inspected, and it was clearly proved that deceased was not pregnant. The defence was — a want of proof that the prisoner believed deceased to have been pregnant, and therefore that the mechanical operation alleged to have been performed might have been resorted to for the purpose of relieving her from other symptoms under which she was suffering. The most important point urged in the defence, however, was, that the crime of abortion was not complete without pregnancy: and therefore the prisoner could not be convicted under the statute. A verdict of guilty was returned; but Coltman, J. on this occasion reserved the question for the consideration of the judges. At the following Assizes, Coleridge, J. delivered judgment. The judges held that the conviction was right. (Med. Gaz. vol. 37. p. 831.)

It is, therefore, established by this decision, that a person believing a female to be pregnant, and perpetrating on her an act which would amount to an attempt at abortion if the female were really pregnant, may be equally convicted under the statute. Hence the words "procure the miscarriage of any woman" do not necessarily include proof of pregnancy, nor can the term "miscarriage" be considered to apply only to a woman in the pregnant condition. It is remarkable that the same question arose under the old statute, 43 Geo. III. c. 58, in which the words "being with child" were used: yet even here Lawrence, J. held that pregnancy was not necessary to be proved, and that the crime of abortion would be complete although the woman was not pregnant. (*Reg.* v. *Phillips*, Paris. Med. Jur. vol. 3. p. 88.)

An attempt made on non-pregnant females should certainly be treated as a crime, and punished accordingly, but, medically speaking, abortion presupposes pregnancy; and if a woman be not pregnant, the carrying out of the intent by the accused is a physical impossibility; yet, as the law is now expounded, a person may be convicted of attempting to procure miscarriage in a female who cannot miscarry. It would appear that according to the law of France proof of pregnancy is not essential. Dr. Bayard relates a case in which a woman was convicted, in 1846, of an attempt to induce abortion in a female who was subsequently proved not to be pregnant, but to be labouring under ovarian disease. The prisoner was sentenced to eight years imprisonment. (Ann. d'Hyg. 1847, t. 1. p. 466.)

Abortion of monsters.—Would the law be applicable to cases in which the child was dead in the uterus, or in which it was a monster without human shape? The symptoms indicative of the death of the child in utero have been elsewhere stated (*ante*, p. 420). The death of the child subsequently to the attempted abortion might perhaps be adduced as corroborative evidence of the crime; but, even if it were dead at the time of the attempt, a conviction would follow. (*Reg.* v. *Goodall*, supra.) It cannot be doubted that the expulsion of a dead child would come under the popular signification of a miscarriage; and if the words were strictly interpreted, a prisoner might be convicted whether the child were living or dead, for it has been already stated, that it is not necessary that any abortion should have taken place. With respect to *monsters*, the question actually arose in a case tried at Drôme, in France, in 1841. (Gaz. Méd., Juillet, 1841; also Brit. and For. Rev. vol. 24. p. 563.) A girl was accused of procuring abortion. The aborted fœtus, of about the sixth month, was acephalous, and there was no vertebral canal for the spinal marrow. Other organs were also deficient or imperfectly formed. The medical witnesses had declared that it had never breathed, and that its life had ceased with gestation. On the upper part of the body was a wound, which had been produced by a pointed instrument, probably just before it was expelled. This they thought had caused death. The counsel for the prisoner contended that this could not be regarded as a case of criminal abortion, owing to the monstrosity of the offspring; and the jury acquitted her. As proof of pregnancy is no longer required, monstrosity in the fœtus should make no difference in the nature of the crime.

Extra-uterine conceptions.—Would the law apply to cases of extra-uterine pregnancy? There can be no doubt that the crime of abortion would apply to cases of this description; and a person would be equally amenable for the attempt, whether the fœtus were in the uterus or in the Fallopian tube. The symptoms of extra-uterine pregnancy, especially of the tubal kind, are very similar to those of ordinary pregnancy; they are not to be distinguished from them in the early stages (see Med. Gaz. vol. 36. p. 103).

Abortion of moles and hydatids.—The use of the word *miscarriage* in the statute, without any explanation of the meaning assigned to it, might, but for the decision in *Reg.* v. *Goodall*, have created some difficulty on trials for abortion. In a popular sense (and here a *popular* appears to have been purposely selected in preference to a medical term), miscarriage signifies the violent expulsion, not merely of a child, but of moles, hydatids, and other diseased growths, or even of coagula of blood. In these last-mentioned cases, the woman is not actually pregnant, although she and the prisoner may imagine that she is. The decision in *Reg.* v. *Goodall* shows that it is unnecessary to speculate on this subject. Whether the uterus contains these morbid growths, or whether it is in the virgin state, the party who has used the means with *intent* may still be convicted of an attempt to procure abortion.

Chemical evidence. Blood in abortion. Liquor amnii.—In the event of an abortion having taken place, stains produced by blood or by the waters (liquor amnii) may be found on the linen of a female, and a practitioner may be required to say whether these stains are of a nature to throw any light upon the perpetration of the crime. A female who has aborted, may allege that the stains are those of the menstrual discharge. Speaking generally, there is no practical distinction between menstrual and other blood (see *ante*, p. 302). The menstrual blood contains less fibrin; it is commonly acid, from admixture with the mucous discharges, and it is found to present under the microscope epithelial scales, or cells from the mucous membrane. These scales or cells belong to the conical or pyramidal variety, and have at their free extremities or bases, ciliary processes. Not much reliance can be placed upon their discovery, since the mucous membrane of the organs of respiration is lined with similar cells. Hence, expectorated blood might be mistaken for menstrual. Cells of a similar shape line the whole of the mucous membrane from the stomach to the anus. The blood of piles might thus be confounded with menstrual blood. The blood discharged in abortion will present the usual characters of blood, elsewhere described (*ante*, p. 302); but it may be diluted by the waters simultaneously discharged. This question received the special attention of the French Academy a few years since, in reference to the crime of abortion, and the report made was to the effect that in the present state of science there was no certain method by which the blood of menstruation could be practically distinguished from the blood discharged from a female in a case of abortion or infanticide (Ann. d'Hyg. 1846, t. 1. p. 181). In a more recent case, MM. Devergie and Chevallier were required to state whether certain stains on the dress of a female supposed to have aborted, were or were not caused by the waters (liquor amnii). A chemical analysis merely revealed the presence of an albuminous liquid. The most elaborate experiments satisfied the reporters that neither by the odour, nor by any other process, could the liquor amnii, dried on linen, be identified. (See Ann. d'Hyg. 1852, t. 2. p. 414.)

BIRTH. · INHERITANCE.

CHAPTER 53.

EVIDENCE OF LIVE BIRTH IN CIVIL CASES—LEGAL RIGHTS OF THE FŒTUS IN UTERO—DATE OF BIRTH—DIFFERENCES BETWEEN ENTIRE AND PARTIAL BIRTH—CASE.—SIGNS OF LIVE BIRTH INDEPENDENT OF RESPIRATION OR CRYING.—MOTION OF A LIMB, OR PULSATION OF THE CORD, A PROOF OF LIVE BIRTH.—VAGITUS UTERINUS—POSSESSIO FRATRIS—TENANCY BY COURTESY.—CÆSAREAN EXTRACTION OF CHILDREN—LEGAL BIRTH.—POST-MORTEM BIRTHS.—MINORITY AND MAJORITY.—MEDICAL EVIDENCE IN RELATION TO PLURAL BIRTHS.—MONSTERS—WHAT CONSTITUTES A MONSTER IN LAW—DEPRIVATION OF LEGAL RIGHTS—DOUBLE MONSTERS—CHRISTINA RITTA—THE SIAMESE TWINS.

Live birth in civil cases.—The law of England has not defined the meaning of the term Birth, in reference to civil jurisprudence; but if we are to be guided by the numerous decisions which have been made on trials for infanticide, it must be regarded as signifying "the entire delivery of a child," with or without its separation from the body of the mother (*ante*, pp. 459, 524. See also Chitty, Med. Jur. 412). So long as an infant remains in the uterus it is said in law to be "*in ventre sa mère*;" but it is legally supposed to be born for many purposes. (Blackstone's Comm. vol. i. p. 130.) A child in the womb may have a legacy or an estate made over to it,—it may have a guardian assigned to it; but none of these conditions can take effect unless the child is born alive. So the fœtus may be made an executor; but it is very properly provided that an infant cannot act as such until it has attained the age of seventeen years! The Roman and English systems of law apply the same term, *venter*, to the unborn child; when born dead it is called *abortus*, abortion; when alive, *partus*, *infans*, infant.

Date of birth.—Medical evidence has occasionally been demanded in Courts of law respecting the actual date of birth of individuals, in cases in which a period of a few days, hours, or even minutes, was required to prove the attainment of majority,—and therefore a legal responsibility for the performance of civil contracts into which the parties had entered, either knowingly or ignorantly, when minors. Some such cases have been decided by the evidence of the accoucheur himself,—others, when the accoucheur was dead, by the production of his case-books; and it is worthy of notice that the strictness and punctuality of some medical practitioners in making written memoranda of cases attended by them, have in more than one instance led to a satisfactory settlement of such suits, and the avoidance of further litigation. The proof of the date of birth is also of considerable importance in certain cases of contested legitimacy.

The most important medico-legal questions connected with this subject, are those which arise in contested suits relative to succession, or the inheritance of property. A child that is born alive, or has come *entirely* into the world in a *living* state, may by the English law inherit and transmit property to its heirs, even although its death has immediately, and perhaps from morbid causes necessarily, followed its birth. Should the child be born dead, whether it died in the womb or during the act of birth, it does not acquire any civil rights: for it is not regarded as a life in being, unless it manifests some sign of life after it is entirely born and separated from the mother. Some have considered that *partial birth*, provided a child is living, should suffice to confer the same rights on the offspring as the proof of entire birth. The following case has been adduced by Dr. Locock in support of this view, although the question here was rather in reference to the actual date of birth than to the acquisition of civil rights therefrom:—the principle is, however, the same. On a Saturday evening a lady was in labour with her first child. The head and one arm were born two or three minutes before a neighbouring clock struck twelve. There was a cessation of pain for several minutes, during which time the child cried and breathed freely. The rest of the body was not expelled until full five minutes after the same clock had struck twelve. Was this child born on the Saturday or on the Sunday? Certainly the birth was not completed until the Sunday: — the child was still partly within the mother: the circulation was still kept up through the umbilical vessels: "but," continues Dr. Locock, "I gave my opinion that the child was born on the Saturday. I considered that the child had then commenced an independent existence. The fœtal life had then to all intents and purposes ceased; and respiration — a function incompatible with the condition of a fœtus — had commenced. The navel-string will, it is true, go on pulsating for many minutes after an infant has been brought completely into the world, crying and kicking, unless it be compressed artificially: and yet no one will say that a child in such a case is not born until we choose to take the trouble to tie the navel-string. The child would not have been damaged if it had remained for hours, or even days, with merely its head and arms extruded: it could have been fed in this situation." (Med. Gaz. vol. 12. p. 636.) However reasonable, *medically* speaking, this view may appear, a medical jurist must shape his evidence according to what the law demands. It has been elsewhere stated (INFANTICIDE, *ante*, p. 459), that our judges have distinctly laid down the law, that no child can be considered to be *legally* born until the *whole* of its body has come *entirely* into the world. This is in relation to criminal jurisprudence, in which case, if in any, the rule should be relaxed; because its relaxation would tend to punish the wilful destruction of living infants partially born. This child could not, therefore, have been born on the Saturday, because the law does not regard partial birth as entire birth; and respiration and birth are not synonymous terms. Supposing this child to have died before its body was entirely extruded, it could not be said, even medically, that it was born alive; and certainly it could not be considered, according to the present state of the law, to have acquired the rights of a child born living. The reasonableness of the opinion that partial birth should suffice for all the legal purposes of entire birth, is an entirely distinct question, and one over which a medical witness has no sort of control. Whatever apparent injustice may be done by adhering to this rule in respect to the civil rights of persons, there is no doubt that the evil is really of great magnitude in relation to criminal jurisprudence; for it would appear from the present state of the criminal law, that partially born children, although alive and healthy, may be wilfully destroyed with impunity (*ante*, p. 460).

On the other hand, some difficulty might arise in civil cases, if the bare extrusion of a *part* of the body sufficed for all the legal purposes of *entire* birth. It might become a casuistical question, as to how much of the body should be in the world in order to constitute legal birth; for there is no reason why, in a medical view, the extrusion of the head and shoulders should constitute birth any more than the extrusion of a hand or a foot. If it be said that the act of respiration should be combined with partial extrusion, this would be unjust; because a child is alive,—its heart is evidently pulsating, and its blood circulating, as freely before the act of respiration as afterwards. Besides, it is admitted that children may be born alive, and live for some time, without respiring; and this want of respiration is no objection to these children being considered living in law. In a case referred to hereafter (p. 588, *infra*), a child was legally pronounced to have been born alive, although it had certainly not respired; and that a child may manifest life for a certain time without leaving in its body any evidence of respiration is clear from cases reported at p. 439. If, then, proof of respiration be not demanded in cases of entire, it could scarcely be required in cases of partial, birth. In the event of partial being treated as synonymous with entire birth, there would be no end to litigation; and medical opinions would vary in every case. It is doubtful whether, under such circumstances, the law could be administered with any degree of certainty or impartiality. Admitting, then, that a child must be *entirely* born, in order that it should acquire civil rights, it will next be necessary to examine the medical proofs required to show that it has been *born alive.* The question here is different from that of live birth in reference to child-murder. We must presume that a practitioner is present at a delivery in which a child is born in a doubtful state, or where its death speedily follows its birth. The civil rights of the child and its heirs will depend upon the careful observation, made by a practitioner, of the circumstances attending the delivery. It is proper that he should note when the birth is completed by the body of the child being entirely out of the body of the mother. Children born at or about midnight are thus liable to have the date of birth wrongly registered; and the legal difference of twenty-four hours, which a few seconds or minutes may make, may hereafter affect their own rights if they survive, or those of others if they die. The birthday of the late illustrious Duke of Wellington was entered in the parish register as the 30th of April 1769, while there is abundant evidence for fixing it on the 1st of May. In fact, he was born just after twelve o'clock in the night between the 30th of April and the 1st of May. Nothing can be more simple than for an accoucheur to fix the true date, not by the hour at which labour commences, but by the time at which it is completed.

Signs of live birth independently of respiration or crying.—The visible respiration of a child after its birth, or as it may be manifested by its *crying*, is an undoubted sign of its having been born alive: but, as it has just been stated, a child may acquire its civil rights, although it may be neither seen to breathe nor heard to cry. The pulsation of a child's heart, or even the spasmodic twitching of any of the muscles of the body, has been regarded as a satisfactory proof of live birth. The latter sign has been judicially so pronounced,—*à fortiori*, therefore, the motion of a limb will be considered sufficient legal evidence in an English Court of law, of life after birth. It is to be observed, that the length of time during which these signs of life continue after a child is born, is wholly immaterial:—all that is required to be established is, that they were positively manifested. A child which survives entire birth for a single instant, acquires the same civil rights as if it had continued to live for a month or longer. In the case of *Fish* or *Fisher* v. *Palmer*, which is reported to have been tried in the Court of Exchequer in 1806, it was decided, upon the opinions of Doctors Babington and Haighton, that a tremulous motion of the lips of a child after birth (while immersed in a warm bath), was sufficient evidence of live birth in law to transfer the estate of the wife to the husband as tenant by the courtesy. Dr. Denman gave a contrary opinion, and assigned the motion of the lips to the remains of uterine or fœtal life.

A question of this nature involves the strict meaning of the term *life* in a physiological sense, and a definition of the properties of *dead* as contrasted with those of *living* muscular fibre. The earliest record which I have been able to find of the case of *Fish* or *Fisher* v. *Palmer*, is in Fodéré (Traité de Médecine Légale, 1813, vol. 2. p. 160). It has been quoted in the works of Gordon Smith, Beck, Paris and Fonblanque, and other medico-legal writers since that time.

The correctness of the decision in this case has not only been challenged, but the actual occurrence of the case has been doubted. It has been contended that there should be, in all cases, evidence, not only of the breathing, but of the crying of a child, in order to justify a medical opinion that it was born alive; but, according to Blackstone (Commentaries, vol. 2. ch. 8. p. 127), "*Crying*, indeed, is the strongest evidence, but it is not the *only* evidence;" and Coke says, "If it be born alive, it is sufficient, though it be not heard to cry, for peradventure it may be born dumb." He also describes "*motion*, stirring, and the like," as proofs of a child having been born alive. So far the decision in *Fish* v. *Palmer* is borne out by good legal authority; and we may consider that although the mere warmth of the body would not be evidence of live birth, yet the slightest trace of *vital* action, in its common and true physiological acceptation — such as crying, respiration, pulsation, or motion — observed after entire birth and separation from the mother, would be deemed in law a sufficient proof of the child having come into the world alive. (See a case decided adversely to this view in France. Ann. d'Hyg. 1832, vol. 1. p. 98.)

A late eminent Scotch judge informed me that in Scotland, the husband's right of courtesy, or life-rent in his wife's estate, depends on there having been a child of the marriage born alive, and for the proof of live birth it is required to be shown, not merely that it had breathed, but that the child had cried after it was born. (Case of *Dobie* v. *Richardson*, Court of Session, 1765.) The last case of this kind came before the Courts in 1833, and by a majority their lordships adhered to the old dicta of the law, and decided that the only receivable proof of life in such a case was that the child had *cried*. They found, that proof that the child was capable of motion, and that it had breathed for three-quarters of an hour, was not sufficient to establish life unless the child had cried! There is reason to believe that, in any future case, this will not be taken as a precedent. The attainment of greater knowledge on the nature and the proofs of life from the results of medical experience and observation, and the fact that these questions have become more generally known and better understood, will probably lead to a different decision. That there should not be a power of proving life (when the death of a child takes place speedily after birth), except by direct proof that the child had cried, is in truth a view of the matter wholly indefensible. From what will be presently said (*Vagitus uterinus*, infrà) it will be seen, that the crying of a child is not necessarily a sign of live birth, for it may cry during the act of birth, and die before its body is born; while the fact that it breathes and moves after birth, although from accidental circumstances it may not cry, is unexceptionable evidence of its having been born alive.

The recent case of *Brock* v. *Killock*, involving a claim by the widow to the estate of her husband, decided by Vice-Chancellor Stuart (April 29, 1861), has confirmed the views here expressed, and supported the decision in *Fish* v. *Palmer*. Dr. Freeman noticed at the birth of the child, and after separation from the mother, that there was a slight pulsation in the cord, showing a feeble but independent circulation in the child. There was no other indication of respiration than an arched state of the chest. This witness and Dr. Tyler Smith stated that in their opinion the child had been born alive. Drs. Lee and Ramsbotham affirmed that the child, in their judgment, was not born alive: and that a child must *respire* before it could be said to possess independent life. The Vice-Chancellor decided that this was not necessary, and held that there was sufficient legal evidence of life after birth in the pulsations observed by the accoucheur. This decision is in accordance with law and common sense. Pulsations indicate an action of the heart, as much as motion of the chest indicates an action of the intercostal muscles. Why these gentlemen should have maintained that there was life with contractility of the intercostal muscles, and not with a contractile power of the heart, is not apparent; but that the opinion expressed is not in accordance with facts, is proved by the cases cited at pp. 438, 440, and 442 *ante*. (For another case in which pulsation was the only clear evidence of life, see p. 617.)

There is no doubt that the best test to apply to such cases for the determination of *physiological* life is *auscultation*. The beating of the heart, as determined by the ear or the stethoscope, applied even for five consecutive minutes, is an undoubted sign of life, in a physiological sense, whether the child breathes, cries, or moves. M. Bouchut noticed, on one occasion, that this kind of passive life continued in an infant for twenty-three hours after its birth. Feeble but distinct pulsations were heard at long intervals, but there was no motion of the ribs. Attempts at resuscitation were made, but the motions of the heart became more and more feeble, until they entirely ceased. An examination showed that the lungs had not received air. As we take the cessation of the heart's action to be the only certain evidence of death, so the existence of pulsations in the heart or arteries, when clearly perceived by the ear, stethoscope or finger, is positive evidence of life in a physiological sense. Is this *legal* life? Would the wilful destruction of such a child constitute murder? Would this proof of pulsation without muscular motion, respiration, crying, or any other sign of active life, confer tenancy by the courtesy, or transfer an estate by inheritance or survivorship. M. Bouchut justly observes that apparent death succeeding to birth, and characterized by the presence of a beating of the heart, and an absence of respiration is only a diseased condition of the new-born child (see Atelectasis, p. 438) and whether it is cured of this or dies,—it is living, although it has not respired—or, as a German jurist remarks—" *Scheintod ist Scheinleben.*" By taking away its rights of succession, the law punishes the child and its heirs for a malady with which it is born (Gaz. des Hôp. 1855, No. 124, and Med. Times and Gaz. Aug. 19, 1856). They who contend that crying or respiration alone should be taken as a sign of life after birth, would of course pronounce such a child to have been born *dead*, even at the time that they might be listening to the pulsations of its heart! Such pulsations would probably be referred by them to the remains of uterine life.

Vagitus uterinus.—Let us suppose that the evidence of a child having been born alive is stated to be, that it was heard to cry:—it may be a question for a medical witness in cross-examination, whether this is to be taken as an absolute proof of live birth. The answer must be in the negative, because a child may cry before its body is entirely born; or there may have been what is called *vagitus uterinus*,—a uterine cry after the rupture of the membranes. (See *ante*, INFANTICIDE, p. 457.) It is quite certain that a child may breathe without crying, but it cannot cry without breathing; yet neither the crying nor the breathing is a necessary proof that the child was born alive. As in all cases of this description there must be eye-witnesses, either professional or not,—the evidence will not rest solely upon a mere medical possibility of the occurrence of such a cry before birth; and proof will be required of the crying of the child *after* it was born.

There are two cases in which the determination of the momentary existence of children after birth is of importance in a legal point of view. These are cases involving the question of Possessio Fratris, and Tenancy by Courtesy.

Possessio Fratris.—In the event of a man twice married dying intestate, and leaving a daughter by each marriage, his estate would be equally shared by the daughters of the two marriages; but if we suppose that there is a son of the second marriage, born in a doubtful state, the legal effect of this child momentarily surviving birth, manifested by some slight sign of life, would be to disinherit the daughter of the first marriage entirely, and transfer the whole of the estate to the daughter of the second marriage, she being sister to the male heir, while the daughter of the first marriage is only of half blood. The determination of this point, which does not often occur, must rest essentially upon medical evidence, when there is a want of clear proof of life after birth. (See Amos, Med. Gaz. vol. 1. p. 738.)

Tenancy by courtesy.—This signifies, according to Blackstone (Com. vol. 2. p. 426), a tenant by the Courts of England. The nature of this tenancy has been already explained. (See the case of *Fish* v. *Palmer*, p. 588, and *Brock* v. *Killock*, p. 590.) If a married woman, possessed of fee-simple estate, die, the estate passes from the husband to her heir-at-law, unless there has been a child born *living* of the marriage, in which case the husband acquires a life interest in the property. The only defence of this singular custom is, that it is of great antiquity. An unsuccessful attempt was made a few years since to substitute for it the reasonable provision, that the marriage should entitle the husband to a right, which he can now only acquire by the fulfilment of certain accidental conditions. Incurable sterility, a protracted labour, deformity in the pelvis of the wife, or the necessary performance of craniotomy on a healthy well-formed child, may, under this custom, lead to an aversion of the inheritance. The tenancy, in contested cases, is generally established or disproved by medical evidence: and the following are the conditions which the law requires in order that the right should exist.

1. The child must be born *alive*. Cases have been already related, wherein the motion of a lip and a pulsation of the cord were held to be sufficient proofs of live birth. Some physiologists have objected to these as inadequate proofs of life, and if the question were one of physiology, and not of law, there might be some ground for the objection. In truth, however, the law does not require proof of *active* life in a child, but merely some evidence, however slight, that it has been born living; and the amount of proof to satisfy the purposes of justice must of course rest with those who are expounders of the law. Rare as these cases are, one has been the subject of two recent trials (*Llewellyn* v. *Gardiner and others*, Stafford Lent Ass. 1854, and *Gardiner* v. *Llewellyn*, Stafford Summer Assizes, 1856.) This was an action of ejectment brought to try the plaintiff's right to a life-interest in the property of his deceased wife. The plaintiff claimed as tenant by the courtesy of England, and his right depended upon whether his deceased wife had had a child born alive. According to the plaintiff's evidence, his wife had taken a long walk, she being at the time in about the seventh month of pregnancy (November 1851), and, having been taken ill during the night, she was suddenly delivered of a child, which lived for about a quarter of an hour. He stated that he heard the child cry. The plaintiff immediately fetched his sister, and returned with her to his wife in a few minutes, and she deposed that she heard the child *cry* twice. This evidence was relied upon as conclusive that the child had been born alive, although it appears on the same evidence to have died before anything could be done to-

wards dressing it. The case for the defendants at the first trial was that the wife was a girl of delicate health and liable to epileptic fits: she had been married by the plaintiff, without the consent of her mother, when little more than sixteen; and evidence was given to show the improbability of the child having been born alive, there being reason to believe, from the conduct of the plaintiff and other circumstances, that it never could have had more than a fœtal existence. There had been no medical examination,—the body was buried the same day, and, as in the case of still-born children, neither the birth nor the burial was registered. Wightman, J. left it to the jury to say whether the positive evidence given by the plaintiff and his sister had been rebutted by the evidence given for the defendant and the other circumstances of the case. The jury found a verdict in favour of the husband's claim. At the second trial ordered by the Court of Chancery (Stafford Summer Assizes, 1856), the plaintiff Llewellyn was made defendant; and medical and other evidence was adduced to show that the child could not have reached an age at which it could either breathe or cry. The age was variously assigned at the fourth or fifth month of gestation. The body of the child was not seen by any medical man, and the non-professional witnesses who saw it differed entirely regarding its size and appearance, so that, in fact, the case rested mainly on the credibility of the statements of Llewellyn and his sister. There were no *medical* facts to guide the jury. The late Baron Alderson, in summing up, said the question simply was whether Eliza Bennett, afterwards Eliza Llewellyn, was delivered of a living child during the time she was a wife. By what was called the "Courtesy of England," a man who married a woman possessed of freehold property, would, if she had had a child born alive during the time they were married, be entitled to the property for his life; but if she had not had a child born alive he would not be entitled to it; that was one of the absurdities of English law! In directing the jury as to the considerations that should guide them in coming to a conclusion, his lordship said they ought to have reasonable and distinct proof of a child having been born alive when its existence was limited to a few minutes, and if a doubt was left in their minds they ought not to find in favour of the birth of the child, because the issue lay to prove that the child was born alive. If they had a doubt on the subject, and could not tell whether it was born alive or not, they must find a verdict for the plaintiffs (Gardiner); they could not find for the defendant Llewellyn unless they were satisfied that the child was in a state of life in the world during the time the husband was married to the wife. The verdict of the jury was to the effect that they did not believe the child was born alive. It was, therefore, a reversal of the former verdict.

It has been usually considered that the *crying* of a child, properly attested by disinterested witnesses, is sufficient evidence of live birth. This is, in fact, one of the tests given by Lord Coke. In the section on INFANTICIDE, some cases have been related in which new-born children survived birth several hours, but manifested no sign of active life either by crying or in any other mode, and after death there was no air in the lungs (see *ante*, pp. 438, 440, 442.) As in cases of infanticide, if the evidence of live birth rests entirely on an examination after death, the absence of air from the lungs will not necessarily show that a child has come into the world dead, nor will the presence of air in these organs prove that it has been born alive, because it may have breathed and died before birth. The child must be heard to cry or seen to breathe or move after birth. The fact that the lungs are not distended with air, and that they immediately sink in water, either when entire or when divided into small pieces, is no proof that a child has not breathed and cried during birth and afterwards. (See cases by Dr. Vernon, p. 439, *ante*; Lancet, Feb. 3, 1855, p. 121; and by Dr. Davies, p. 442.) Although in Dr. Vernon's case, the child had only reached the sixth month, it was strong enough to cry, and yet probably, had its history been unknown, a medical witness would have been prepared to swear from an observation of the lungs that it must have been born dead, and certainly could not have had the power of uttering a cry! A child born at the fifth month has been known to cry (see *post*, LEGITIMACY, p. 616); but the state of its lungs is not recorded. In the case of *Gardiner* v. *Llewellyn* (*ante*, p. 592), a medical witness who appeared for the plaintiff stated as his belief that a child born at the fifth month could *not respire*, and if it could not breathe (so as to fill the lungs) it could not cry! This may have been consistent with his experience, but it is not consistent with facts observed by others. One of the greatest difficulties that lawyers have to contend with in getting at medical truth is, in this strong disposition on the part of witnesses, to act upon a foregone conclusion, and to "fix" all natural events by an exclusive reference to their own experience.

2. The child must be *born* while the *mother* is *living*. From this it appears that if a living child were removed from the outlet after the death of the mother, or extracted by the Cæsarean operation from the uterus, the husband would not become entitled to enjoy his wife's estate; although the child might survive its removal or extraction, and succeed to the estate on attaining its majority. How such a case would be decided in the present day it is difficult to determine: but one instance is quoted by most medico-legal writers from Lord Coke, in which, about three centuries since, the case was decided against the husband, in consequence of the child having been removed from the uterus by the Cæsarean section *after* the death of the

wife. (For a singular case involving this question in France, see Ann. d'Hyg. 1138, vol. 1. p. 98.) In the case of Llewellyn (*suprà*) the late Baron Alderson ruled that the husband could not take the estate unless the child were born during the marriage.

Cæsarean Extraction.— The Cæsarean operation has rarely been performed in England, except when a female was actually dying or dead. Dr. Goodman, of Manchester, has collected and published, from the table of Dr. Merriman and other sources, an account of thirty-eight of these operations performed in this country since 1737. It appears that out of this number only three mothers have recovered, the children, with one exception in the three cases, having died. In eighteen cases the children were extracted living. (Obstetric Record, No. 4, 1848, p. 3.) Dr. Goodman himself performed this operation successfully on a female in November 1845. This child was extracted alive, and the woman perfectly recovered from the operation. (Med. Gaz. vol. 36. p. 1392.) The husband or representative of the deceased parturient woman, may object to the performance of this operation, even although the child may be living in the womb, and there may be a reasonable hope by an immediate operation of extracting it living. The late Dr. Lever informed ne that on two occasions in 1858, the husbands thus refused to llow him to operate on the dead body of the wife. I apprehend that no medical man would proceed to operate by force, or against the will of the husband: at the same time, in refusing his permission, the husband is not guilty of any legal offence. The practice on the Continent has been to undertake it while the woman was living, and the result has shown that it may thus be performed successfully both with regard to mother and child. (See Med. Gaz. vol. 19. pp. 822, 878; Cormack's Monthly Journal, July, 1845, pp. 541–543.) For a case in which this operation was successfully performed three times on the same person, see Brit. and For. Med. Rev. July 1836, p. 270. Important legal consequences may hereafter ensue from a more general adoption of this practice in England in respect to deformed females. Thus, supposing in any case a child were removed alive while the mother was living, both of them dying shortly afterwards,—Would the husband become a tenant by the courtesy? The law says the child must be *born:* and some lawyers would find ground for arguing whether extraction by the Cæsarean operation should be regarded as "legal birth." "Illud autem valdè controversum est inter jurisconsultos, an is qui editus est exsecto matris ventre reputetur partus naturalis et legitimus et successionis capax." (Caranza.) According to Fonblanque, the question is settled in the affirmative—a child extracted is a child born. (Med. Jur. vol. 1. p. 236.) Our ancient law-authorities do not appear to have contemplated that the operation would ever be undertaken on a living female. The words of Lord Coke, which are considered to express the state of the law, are:—"If a woman seized of lands in fee taketh husband, and by him is bigge with childe, and in her travell dyeth, and the child is ripped out of her body alive, yet shall he not be tenant by the curtesie, because the child was not born during the marriage, *nor in the life of the wife*, but in the meantime her land descended." According to Mr. Hobler, the Cæsarean operation does not divert the course of descent, or divest the husband of the life-estate, provided the child be born alive, and the mother was living when the child was born. (Obstetric Record, vol. 3. p. 66.) *Birth*, and extraction by the Cæsarean operation, are, therefore, treated by him as similar conditions.

As a proof that this operation is not always necessary, even when circumstances may appear to call for it, the following case, mentioned by Sir B. Brodie as having occurred in a French hospital, is of some interest. It is that of a woman whose pelvis was considered to be too narrow for the egress of the child. As she was at the full term of gestation, the Cæsarean section was proposed, but before the operators were ready to commence, the child was expelled by the natural efforts of the uterus, or, as a medical authority expressed it, the child preferred coming into the world by the old road! (Lancet, Dec. 1853.) This, however, is not the only case of the kind on record. There is great reason to believe that continental practitioners are too officious in suggesting the performance of this operation, and that it is often undertaken to the serious risk of the life of a female, when the case, if left to nature, would have done well. A case is reported to have occurred in Scotland in 1847, in which the Cæsarean operation was considered by several practitioners of experience to be the only means by which delivery could be accomplished. Fortunately for the female, the labour was somewhat rapid, and she was delivered of a dead child, weighing about three pounds, before the arrival of those who had considered that the operation would be required. (Ed. Monthly Journ. July 1847, p. 30.) The fact is, on these occasions nature often adapts means to ends in a most unexpected manner. A case of the performance of this operation on a living female has been reported by Mr. Skey. Here sufficient time was allowed for the advancement of the labour, and it was evident to all that delivery could not take place by the outlet: that embryotomy could not be performed; and that unless the operation was resorted to, the female would infallibly sink from exhaustion. The child was extracted, but the mother died in about thirty-six hours. (Med. Gaz. vol. 39. p. 212.)

Medical jurists have differed respecting the period of gestation at which the operation should be performed. This would of course depend on the earliest period at which a child might be born capable of living. In reference to tenancy by courtesy, a child might be extracted alive as early as the fifth month; but it would not be likely to survive unless it was at or about the seventh month. Some have alleged, that unless performed *immediately* after the death of the mother, the child would not be extracted living. The condition of the fœtus in utero is, however, peculiar, and quite distinct from that of a child living by the act of respiration. It is possible, therefore, that there may be a limited survivorship, and that the operation may be performed so late as an hour after the death of the mother with the possibility of extracting a living child. There are incredible accounts of children having been extracted living, many hours after the death of the mother. Dr. Kergaradec states that this happened in the case of the Princess Pauline of Schwartzenburg, who, while pregnant, was burnt to death at the ball given on the occasion of the marriage of the Empress Maria Louisa in 1810. The body was not examined until the following day, and the fœtus is stated to have been then found living! (Ann. d'Hyg. 1846, vol. 1. p. 454.)

Birth after the death of the female.—That a child may be born after the death of the female, and survive its birth, is proved by the following case. A woman died during labour. The accoucheur, who was summoned, found the head of the child presenting, but too high up in the pelvis to allow of the application of the forceps. He immediately introduced his hand into the uterus; and a quarter of an hour after the death of the mother, and twenty hours after the rupture of the membranes, he extracted a male infant in a state of apparent death. The child, which was well-formed, was speedily resuscitated by the application of the ordinary means. (Berlin Medicin. Zeit. July 1836.) Had this case occurred in England, it would probably have been decided, according to the old precedent, that the husband could not become a tenant by courtesy, because by the death of the mother the marriage was dissolved and the land descended before the child was born! Another case of the birth of a living child after the death of the female, will be found recorded in the Med. Gaz. vol. 46. p. 713; and a third, in which a dead child with the placenta was expelled from the uterus many hours after death, is reported in Casper's Vierteljahrschrift, 1861, vol. 1. p. 163.

3. The child must be born capable of inheriting; therefore if it be a *monster*, the husband does not acquire the right of tenancy. There are some other legal conditions which must also be fulfilled, but I have here confined my remarks to that which may become matter for medical evidence.

Admitting that there are legal proceedings by which the ob-noxious parts of this ancient custom may be set aside during the life of the wife, it is hardly just that the knowledge of the necessity for these precautions should be left to be acquired by accident. It would be better to abolish tenancy by courtesy altogether, than to allow the succession of a husband to his wife's estate to rest upon a casualty of this kind.

Minority and majority.—The word *minor* is synonymous with that of *infant*, and is applied in law to any one under the age of twenty-one years. The age of a person may render him incompetent to the performance of civil duties. Minors are frequently called upon to act as witnesses in civil and criminal cases. In rapes committed upon young females, it is especially important to notice whether the prosecutrix be or be not competent to give evidence. The law has fixed no age for *testimonial* competency; and I have never heard of the question being referred to a medical practitioner. The child is always orally examined by the Court; and it is soon rendered apparent whether the witness possesses a proper knowledge of the nature and obligations of an oath. If not, his or her testimony is not received, or, in a case of rape, the trial is postponed, and the child is placed under instruction, to appear again at the following sessions or assizes. The competency of a child as a witness, therefore, does not depend on age, but upon its understanding. In respect to criminal responsibility as affected by age, it was held by Keating, J., in a recent case (*Reg.* v. *Cowl y*, 1860), in which the prisoner, a boy, aged *eight* years, was charged with felony, that up to seven years of age the law presumed that a child could not distinguish right from wrong, so as to be capable of crime: and evidence was not admissible to prove that he possessed that capacity. But after the age of seven, and up to fourteen, though the law presumed a child to be *primâ facie* incapable of crime, this presumption might be rebutted by evidence which showed that he had what was called a mischievous discretion. In the present case there was no evidence of that sort, and therefore his lordship directed the jury to acquit the prisoner.

According to the principles of our law, a male at twelve may take the oath of allegiance; at fourteen he is considered to be at years of discretion, and becomes then responsible for his actions; at twenty-one he attains majority, and is at his own disposal, and may alienate his lands, goods, and chattels by deed or will. It is only when this age has been attained that an individual can be sworn to serve on a jury. The period at which a male is considered to have attained full age varies in different countries: thus, in the kingdom of Naples it is fixed at eighteen years: in Holland at twenty-five: but generally throughout the states of Europe the law prescribes twenty-one years, the same as the common law of England.

A person is completely of age the first instant of *the day* *before* the twenty-first anniversary of his birth-day, although forty-seven hours and fifty-nine minutes short of the complete number of days counting by hours; and this mode of calculating age and time is applicable to all the other ages before and after twenty-one. This is on the principle that part of a day is equal to the whole of a day in a legal point of view. The following case in reference to this question was decided by appeal in the House of Lords in February 1775. An estate was bequeathed to a Thomas Sansom so soon as he should arrive at the age of twenty-one. He was born between the hours of five and six on the morning of the 16th August, 1725, and died about eleven in the forenoon on the 15th August, 1746. The question was, whether he had, at the time of his death, arrived at full age. In the Court of Chancery it had been so decided; but it was urged that more than sixteen hours were wanting to complete the full term. This plea was overruled by their Lordships, and the decree confirmed, because the deceased was living on the day which would have completed the period. A few minutes or hours may thus determine the attainment of majority, and with this, the responsibility of minors for civil contracts or the validity of their wills. By 1 Vict. c. 26, no will made by any person under the age of twenty-one years shall be valid; and as the day of a person's birth is included in the computation of his age, and there being in law no fraction of a day, a will may be made at any time on the day before that which is usually considered the twenty-first anniversary of birth.

Plural births.—This has been regarded as a subject appertaining to medical jurisprudence; but I am not aware that there is any case on record in which the evidence of a medical man has been required respecting it. It is a simple question of primogeniture, which has been generally settled by the aid of depositions or declarations of old relations or servants present at the birth. Women may have two, three, four, or five children at a birth. Twins are comparatively frequent, but triplets and quadruplets are very rare. A case of triplets is reported in the Lancet for October, 1853, p. 316. According to Dr. Rüttel, out of 574,293 births in the kingdom of Prussia in 1840, there were 6381 cases of twins, 72 of triplets, and one of quadruplets. This writer knew an instance in which a woman had *six* children at a birth. (Henke, Zeitsch. 1844, p. 226; and Med. Gaz. vol. 36. p. 607.) Mr. Guthrie states that in the museum of the Royal College of Surgeons "there is a large bottle containing five young ladies and gentlemen, all brought forth at one birth, and destroyed by an accident;" and that he was for many years acquainted with a gentleman whose mother produced twenty-eight living children in the first twelve years of her married life. (Lancet, Feb. 15, 1851. p. 176.) Mr. Russell met with a case, in 1849, in which there were five children at a birth. They were all males, and all born dead. The largest was six inches, and the smallest was five inches long. They were prematurely born. There was one placenta of the ordinary size, with five umbilical cords attached to it round its centre. (Lancet, Feb. 3, 1849.) Mr. Young states that he attended a woman who was delivered of four male children at one birth, three being from seven to eight months. They survived to the following day. One of the four was a fœtus of from fifty to sixty days, apparently showing conception at different periods. There was a placenta with four navel strings quite distinct. (Lancet, March 1, 1856, p. 234.) Mr. Black, of Austruther, has reported the case of a woman who was delivered on the 30th June 1845, of four children, two males and two females. Three of the children weighed nearly four and a half pounds each. They were alive and thriving on the 12th February following. (Northern Journal of Medicine, March 1845, p. 265.) The only circumstance with respect to these plural births which it has been recommended that an accoucheur should attend to, is the order of their occurrence. The first-born child according to an ancient principle of the common law of this country, succeeds to the inheritance. In cases of twin or triplet males, a practitioner would find himself much embarrassed to express an opinion as to which was first born after the lapse of a certain period, unless there was some personal peculiarity or deformity which would at once enable him to stamp the identity of a child.

There is one case in which the law has interfered to prevent the inheritance of offspring, and this is in relation to monstrous births.

MONSTERS.

The connection of teratology with medical jurisprudence has been most ably investigated by M. St.-Hilaire. Although questions connected with monstrous births do not often occur, yet it is proper that a medical witness should be acquainted with certain facts respecting them. The law of England has given no precise definition of what is intended by a monster. According to Lord Coke, it is a being "which hath not the shape of mankind; such a being cannot be heir to or inherit land, although brought forth within marriage." A mere deformity in any part of the body, such as supernumerary fingers or toes, twisted or deformed limbs, will not constitute a monster in law, so far as the succession to property is considered, provided the being still have "*human shape.*" Even a supernumerary leg would not probably be allowed to avert an inheritance! A trisceles monster, in which the third leg was a fusion of two legs, was exhibited in London in 1846. (See Med. Gaz. vol. 37, p. 619.) From Lord Coke's description, it is obvious that the law will be guided in its decision by the description of the monstrous birth given by a medical witness. It would not rest for a witness to say whether the being was or was not a monster—the Court would draw its inference from the description given by him. Various classifications of monsters have been made, but these are of no assistance whatever to a medical jurist, because each case must be decided by the peculiarities attending it; and his duty will not be to state the class and order of the monster, but simply in what respect it differs from a healthy organized being. In consequence of the want of a sufficient number of precedents on this subject, it is difficult to say what degree of monstrosity would be required in law in order to cut off the civil rights of a being. There are acephalous, dicephalous, and disomatous monsters; others again, like the Siamese twins, have two bodies united by a mere band of integument. Would an acephalous monster be considered as devoid of human shape? Would a disomatous monster be allowed to inherit as one?—to marry as one?—or how would legal punishment be inflicted in the event of one of the bodies infringing the laws? Such are the singular questions which have been propounded by medical jurists in relation to these beings; and there is obviously ample room for the exercise of much legal ingenuity in respect to these questions. According to St.-Hilaire, the rule which has been followed in all countries respecting these monstrosities, is to consider every monster, with two equally developed heads, whether it be disomatous or not, as two beings; and every monster with a single head, under the same circumstance, as a single being. He ascribes the origin of this rule to the performance of the rite of baptism in all Christian countries upon each head, when the monster is dicephalous. This view appears rational, when we consider that with two heads there are two moral individualities; while with a single head, there is one will and one moral individuality. But it is doubtful how far this doctrine would be accepted by jurists and legislators. The question whether, in a dicephalo-disomatous monster, the two beings should be bound by the act of one, either in civil or criminal jurisprudence, is a matter which, if these monstrosities were more frequent, would give rise to serious difficulties. Such a question is not purely speculative, because it might easily have been raised in respect to the Siamese twins during their stay in this country; and according to St.-Hilaire, a case of this kind was actually decided in Paris in the seventeenth century, in relation to a double-headed monster. The author relates that this double monster killed a man by stabbing him with a knife. The being was condemned to death, but was not executed on account of the innocence of one of its component halves! (Ann. d'Hyg. 1837, vol. 1. p. 331.) According to the same authority, compound monstrosity is not transmissible by generation. The reader will find an account of the most remarkable monsters born during the present century in a paper by Dr. Rüttel (Henke, Zeitschrift der S. A. 1844, p. 229). Among them is mentioned a tricephalous monster born living in Paris in 1830. Each head was baptized under a separate name. Monsters, especially the dicephalous, are either born dead or die soon after birth; yet within a recent period two have been known to live; the one, Christina Ritta, for nine months,—the other, the Siamese twins, may be still living.

Christina Ritta was born in Sardinia in 1829. This monster was double from the head to the pelvis; the two vertebral columns being distinct as far as the os coccygis. The left bust was christened by the name of Christina, the right by that of Ritta. The monster was brought to Paris, where it died about *nine months* after its birth. An excellent model of it may be seen in the museum of Guy's Hospital, together with some good specimens of the dicephalous and disomatous varieties. In the further description of it, it may be observed, that below the pelvis the monster is single. There are two heads resting on two necks; and the union or fusion of the two busts is effected laterally towards the middle portion of the chest, so that the two corresponding breasts are almost blended. The abdomen, as well as the pelvis, evidently formed by the junction of two primitive pelves, is single. In the chest there were found two distinct sets of lungs and two hearts; but these were inclosed in a single membrane (pericardium.) During life the pulsations of these organs were so uniform that there was considered to be only a single heart. There was only one diaphragm, a fact which accounted for the simultaneous death of both bodies; one only having been previously indisposed

The *Siamese Twins*, born in 1811, may be regarded as forming the most remarkable duplex monster of modern times Many professional men must have had an opportunity of seeing them when exhibited in London in 1830. There was such a resemblance in their features that it was impossible to distinguish them except by remembering their position as to the right or left hand: They had distinct volitions, and could converse at the same time on different subjects with different persons; their movements were simultaneous, so as to appear like those of a single being. In short, they could be regarded in no other light than as two distinct beings united at the abdomens by a narrow fleshy band. this band of union was, however, so intimate as to render it probable that they had only one peritoneal cavity between them. When either coughed, the band swelled up in its whole length: this formed an insurmountable obstacle to their separation. It would, however, have been impossible, in relation to civil and criminal jurisprudence, to have made both responsible for the acts of one, since they occasionally differed in opinion! Dr. Fifield, of Weymouth, Massachusetts, has informed me that in July 1853 the Siamese twins were residing on a large plantation which they possessed in Chester County, North Carolina. They had then attained the mature age of forty-two. Some medico-legal difficulties of a civil nature had been solved by their entering into a matrimonial state. They were married to two sisters, and therefore had entered into the contract as separate beings: but no charge of bigamy had arisen out of this double union. It is probable, also, although I have no information on this point, that they enjoy the rights of citizenship as two independent beings. It is clear from this independence of will and action, that one might kill a person under circumstances which would constitute murder or manslaughter, the other not being an assenting party and endeavouring to prevent the perpetration of the crime. The application of the criminal law would, as in the Parisian case related by St.-Hilaire, become a subject of great difficulty. No punishment could be inflicted on the guilty without necessarily involving the innocent (undivided) moiety. Such a case of monstrosity is quite *sui generis*, and must be regarded as setting at defiance all the ordinary rules of law, whether civil, criminal, or canonical.

For an account of a case of a monocephalic disomatous monster which was born alive, but died soon after birth, see Ed. Med. Jour. vol. 55. p. 76; and at page 435 of the same volume is an account of a dicephalous monster born at Manchester in 1840.

Malpositions, transpositions, or defects of the internal organs of any of the cavities, do not form monstrous births within the meaning of the English law. The legal question relates only to *external* shape, not to *internal* conformation. It is well known that many internally malformed persons live to a great age; and it is not until after death that malpositions and defects of this kind are discovered. In French jurisprudence the case appears to be different: if the malposition or defect was such as to become a cause of death soon after birth, the child would be pronounced not "*viable*," and therefore incapable of acquiring civil rights. Some medical jurists have discussed the question of "*viability*" in new-born children, *i. e.* their healthy organization with a capacity to continue to live, as if it were part of the jurisprudence of this country; but I am not aware of any facts which bear out this view (p. 413). The English law does not regard *internal* monstrosity as forming a bar to civil rights: and the cases of *Fish* v. *Palmer*, of *Brock* v. *Killock*, 1861, and of *Llewellyn* v. *Gardiner* (ante, pp. 588, 591), show clearly that the simple question in English jurisprudence is, not whether a child is or is not "*viable*," but whether it has manifested the least sign of life after it was entirely born. The French law is much more complex, and throws a much greater degree of responsibility on French medical jurists. (See *Viability*, p. 613.) It is proper to state that no person is justified in destroying a monster at birth. (See *ante*, p. 484.)

LEGITIMACY.

CHAPTER 54.

LEGAL PRESUMPTION OF LEGITIMACY—DATE OF CONCEPTION NOT REGARDED—DIFFERENCE BETWEEN THE ENGLISH AND SCOTCH LAW. CHILDREN BORN AFTER DEATH. NATURAL PERIOD OF GESTATION—DURATION FROM ONE INTERCOURSE. PREMATURE BIRTH—SHORT PERIODS OF GESTATION. VIABILITY—EARLIEST PERIOD AT WHICH A CHILD MAY BE BORN LIVING. FAMA CLAMOSA—EVIDENCE FROM THE STATE OF THE OFFSPRING—CAN FULLY DEVELOPED CHILDREN BE BORN PREMATURELY?—PROTRACTED BIRTHS. LONG PERIODS OF GESTATION—CASES—LONGEST PERIODS YET KNOWN—THE SEX OF A CHILD HAS NO INFLUENCE—PERIOD NOT FIXED BY LAW. EVIDENCE FROM THE STATE OF THE CHILD—LEGAL DECISIONS—MISTAKES IN THE MODE OF COMPUTATION.

Legal presumption of legitimacy.—Every child born either in lawful matrimony, or within a period after the death of the husband in accordance with the natural duration of gestation, is considered by the English law to be the child of the husband, unless the contrary be made clearly to appear by medical or moral evidence, or by both combined. It is only in reference to *medical* evidence that the subject of legitimacy can here be considered; but it is extremely rare to find a case of this kind determined by medical evidence alone. There are generally circumstances which show that a child whose legitimacy is disputed, is the offspring of adultery, while the *medical* facts may be perfectly reconcilable with the supposition that the claimant is the child of the husband. These cases therefore have been repeatedly decided from *moral* evidence alone,—the medical evidence respecting the period of gestation or physical capacity in the parties leaving the matter in doubt. The law which formerly prevailed in this country was to the effect, that if a child were born during marriage,—the husband being within the four seas of the realm (*intra quatuor maria*), and no physical impossibility being proved, the child was legitimate. Access was presumed unless he could prove that he was "*extra quatuor maria*" for above nine months previously to the birth. (Blackstone, vol. i. p. 456.) But the present state of the English law on the subject appears to be this. A child born during marriage is deemed illegitimate, when by good medical or other evidence it is proved that it was *impossible* for the husband to be the father,—whether from his being under the age of puberty, from his labouring under physical incapacity as a result of age or natural infirmity,—or from the length of time which may have elapsed since he could have had intercourse, whether by reason of absence or death. With proof of non-access or immorality on the part of the mother, so important on these occasions, a medical witness is not in the least concerned. In a case of voluntary separation of husband and wife, which the law does not recognize, the children born are the children of the husband, unless non-access can be clearly proved. In January 1849, a woman applied to a magistrate for a summons against a man to show cause why he refused to contribute to support a child of which she declared him to be the father. It appeared that she parted voluntarily from her husband, and had lived three years with the adulterer, and during the last year this child was born. The magistrate declined granting the summons, as she had no claim upon the adulterer. There was opportunity of access on the part of the husband, and he alone was liable in law for the maintenance of the child. In some instances, the law assumes without medical evidence that the offspring is illegitimate, as where the husband and wife have been legally divorced "*a vinculo matrimonii*." When children are born where the divorce is "*a mensâ et thoro*," they are presumed to be illegitimate until the contrary appear. There is a peculiar difference in relation to legitimacy between the laws of England and Scotland. A child born of parents in Scotland before marriage, is rendered legitimate by their subsequent marriage. In England the offspring is illegitimate, whether the parents marry or not after its birth; and under the Poor Law Act, 4 and 5 Will. IV., if a man marry a single woman having a child or children living, of whom he is not the father, he is bound to maintain them, as if they were his own and born after marriage. At the same time the children are not legitimated by the marriage. In the case of *Birtwistle* v. *Vardell*, decided on appeal by the House of Lords, in August 1840, it was held that a child thus legitimated by the law of Scotland, could not be allowed to succeed to his father as heir to real estate in England. The Scotch rule appears to be more consistent with natural justice; since, according to the English practice, it is inflicting confiscation on the offspring for a fault in the parents, which they had done all in their power to amend. (See also the case of *Dalhousie* v. *M'Douall*, on appeal to the House of Lords, March 1840.) These suits are chiefly instituted in respect to the right of succession to property or claims for peerages; and medical evidence is then frequently required to clear up the case.

From what has been stated, it will be perceived that the English law does not regard the date of *conception*, which cannot be fixed, but the date of *birth*, which can be fixed. Medical evidence may relate—1. To the actual length of the period of gestation:—this may be in a given case so short or so long, as to render it impossible that the husband could be the father. 2. There may be physical incapacity in the husband,—he may be too old or too young,—or he may labour under some physical defect rendering it impossible that he should be the father. 3. There may be sterility or incapacity in the female, rendering it impossible that the child should be the offspring of a particular woman:—in other words, the claimant may be a supposititious child. (See SUPPOSITITIOUS CHILDREN, *post*, p. 645.)

Children born after the death of the wife or husband.—It appears that a child born *after* the death of the mother, provided she has been lawfully married, is legitimate, although the marriage is dissolved by the death. This is not a mere hypothetical question. Two cases have already been quoted (*ante*, p. 597) in which living children were born after the death of the females: these facts are of especial interest in relation to tenancy by courtesy. Whether the birth take place by the aid of art through the outlet, or by eventration, as in the Cæsarean section, the husband, if the wife be at the time legally dead, cannot claim the estate; but the child thus born out of marriage is legitimate, and if it live, may, on attaining its majority, take the estate of which the mother was seised. (See ante, *Cæsarean operation*, p. 594.) The fact that the English law disregards the place or date of conception might therefore give rise to a singular question. A child may have been conceived before the marriage of the parents, and be brought into the world by the Cæsarean operation after the death of the mother. Hence it would neither be *begotten* nor *born* in wedlock, and yet, according to the principle of the English law, it would be the legitimate offspring of the marriage.

It frequently happens that a child is born after the death of the husband. Conception is assumed to have taken place during wedlock, and although the child is not born in wedlock, the presumption is in favour of legitimacy, unless non-access or physical incapacity be distinctly proved. The legal questions which may arise under such circumstances are elsewhere considered (see *post*, POSTHUMOUS CHILDREN, p. 639). Hence *conception* during wedlock, and *birth* after the dissolution of the marriage by death,—or conception before wedlock and birth during that state,—or conception and birth during lawful wedlock, equally create a presumption in favour of the legitimacy of offspring.

Natural period of gestation. Duration from one intercourse.—The first point to be considered is,—what is the natural period of gestation, and whether this is fixed or variable. According to the testimony of experienced accoucheurs, the average duration of gestation in the human female is comprised between the *thirty-eighth and fortieth weeks* after conception. Numerous facts show that the greater number of children are naturally born between these two periods. Out of 186 cases reported by Dr. Murphy, the greater number of deliveries took place on the 285th day. (Obstetric Report, 1844.) Among five hundred cases observed by the late Dr. Reid there were 283 cases in which the period of gestation was within 280 days; and 217 cases in which it went beyond this period. Dr. Duncan found in a group of forty-six cases, that 275 days is the average interval between that which he terms insemination (intercourse) and parturition. The largest number of cases on any particular day was seven on the 274th day. (Ed. Monthly Journal, 1854, vol. 9. p. 230.) The most common cause of this variation in time is, that the usual mode of calculation by reference to the suppression of the menstrual discharge, even in a healthy female, may lead to a possible error of two, three, or even four weeks, since there is no sign whereby, in the majority of women, the actual time of *conception* can be determined. Some females have been able to determine by peculiar sensations the time at which they have conceived, but as a general rule this must be a matter of pure conjecture when they are living in connubial intercourse.

On the other hand, accidental and isolated cases have clearly proved that a great difference naturally exists among females with respect to the period of gestation; and it is probable that in no two is it necessarily the same. When there has been only *one* intercourse, the duration of pregnancy may be calculated without reference to any changes in the female constitution: for the date of conception, within certain limits to be presently mentioned, would be fixed. Observations of this kind have shown that females have differed from each other; and in several instances the time has exceeded or fallen short of the period of forty weeks, which has been usually set down as the limit of natural gestation. In three cases of this kind known to the late Dr. Rigby, labour came on in 260, 264, and 276 days, making a difference of sixteen days. (Med. Times, March 14, 1846, 471.) In three other instances which were privately communicated to me by Dr. S. W. J. Merriman, labour commenced at 281, 283, and 286 days respectively after one intercourse; and in a case which occurred to Dr. Reid, the labour did not commence until after the lapse of 293 days from a single intercourse. (Lancet, July 20, 1850, p. 79.) In two cases communicated to me by the late Mr. Carrington in November 1857, the females were delivered respectively in 249 days, and in 260 days after a single intercourse. In a third in which pregnancy was the result of a rape, there was an interval of 261 days between intercourse and delivery. Hence it will be perceived that in well-observed cases, where there could be no motive for misstatement, and in which the characters of the females, some of whom were married and had already borne children, were beyond the reach of suspicion, a difference of not less than *thirty-three days* has been observed to occur.— *i. e.* between the earliest case recorded by Dr. Rigby, and the latest reported by Dr. Reid. This is worthy of remark, because in a case referred to hereafter (*Luscombe* v. *Prettyjohn*), *post,* p. 632), it was held that 299 days, only six days longer than in Dr. Reid's case, was an *impossible* period for human gestation! In addition to the above facts, showing the variability of the period after a single intercourse, the following may be cited. Dr. Macilwain, U.S., has reported a case of gestation, which he thinks must have extended to 296 or at least to 293 days. (Amer. Jour. Med. Sci. July, 1848.) In the same journal for July 1845, p. 241, there is recorded the case of a woman, a primipara, who was delivered on the 309th day after a single intercourse. Dr. Lockwood has published the following as the result of his experience. The actual duration of the term of gestation in the human subject, *i. e.* the interval between intercourse and delivery, was ascertained by him in four cases: — No. 1, aged 19, duration 272 days, first confinement: No. 2, aged 30, first confinement, duration 276 days; No. 3, aged 17, duration 270 days; No. 4, aged 44, seventh confinement, duration 284 days, the child weighing fourteen pounds. (Brit. Amer. Jour. Dec. 1847, p. 214.) M. Devilliers has also published the particulars of nine cases, in which the interval from a single intercourse was accurately determined. Delivery took place at the following periods: 229, 246, 257, 267, 301, 276-281, 278-283, 270, and 266-272 days, making an extreme difference of 49 days in the earliest and the latest periods between intercourse and delivery. (Gaz. Méd. Mars 4, 1848.)

Cause of the variations.— From analogical observations made on animals, it has been supposed that this variation in the period depended on the male: others have assigned it to peculiarities in the female constitution. It appears probable, from recent researches, that the duration of the pregnant state is dependent on the relative excitability of the uterine system at the menstrual periods. Numerous facts tend to show, that, notwithstanding the general suppression of the menses, there is great excitement of the uterine system at what would have been, in the unimpregnated state, the regular menstrual periods. Sometimes, as it has been elsewhere stated, this really amounts to a periodical discharge of blood. There is also great reason to believe that abortion takes place more readily at these than at other periods. Hence some accoucheurs are inclined to consider that the duration of pregnancy is really a multiple of the menstrual period: and that in the majority of females it will occur at what would have been the tenth menstrual period, or forty weeks from the date of intercourse and supposed conception (Gaz. Médicale, 4 Decembre, 1847, p. 968); and according to the degree of excitement of the uterine system, the child may be expelled a period earlier or a period later than that which is assigned as the more usual natural term. It is in some respects a confirmation of this view, that the menstrual function is again frequently established one month after parturition. Dr. Reid, however, states that the exceptions to this are so numerous as to destroy its value as a rule. Admitting that conception may occur at any time between two menstrual periods, this theory will explain the variations which have been noticed in the duration of pregnancy after one intercourse. Dr. Rigby thinks that parturition takes place at the fortieth week, because the development of the child then acts by distending the uterus, which, in its irritable state, tends to throw it off. It is not, however, found that the duration of pregnancy is at all dependent on the size and weight of the child, or that children born at the fortieth week resemble each other in these respects. Hence the commencement of parturition cannot be ascribed to the physical conformation of the child. It would be desirable to know whether this periodicity can be invariably traced in the time at which labour commences. Some females menstruate every three weeks: so far as I can ascertain, it has not been shown that in them the correspondence of gestation to the menstrual periods has been made out. Such females should, according to the theory, bear children to the thirteenth period from the date of the last cessation. Dr. Clay believes, from the observations which he has made, that the variation in the period of gestation is dependent on the age of the female as well as of the male. He considers that the term of gestation is extended in proportion to the age of the female; and that while in a female of 17 the period may be taken at 270 days,—in a woman of 44 it would extend to 284 days. Again, when a female has been impregnated by a male much older than herself, the term of utero-gestation, is, in his opinion, longer than would be assigned to a female of this age, and *vice versâ.* (Record of Obstetric Medicine, June 1848, p. 212.)

It has been supposed that cases of lengthened gestation were nothing more than instances of protracted parturition: the pains indicative of delivery commencing at the usual time, but continuing more or less over a much longer period than usual. In an instance mentioned by Dr. Jörg, a woman went her full time, but the parturition lasted a fortnight longer, the symptoms appearing and then disappearing. Admitting that this occasionally happens, still it shows that gestation from a particular pregnancy may be protracted considerably beyond the ordinary period.

There is no reason to believe that the *sex of the child* has any direct influence on the length of the pregnancy. It has been stated that gestation was longer with male than female children; and evidence of this kind was tendered in the Gardner Peerage case. A medical witness then asserted that the average period was 280 days for a female, and 290 days for a male child. The Solicitor-General very properly inquired — Supposing the child is an hermaphrodite, what then is the time? The witness said—He would take between the two! It is not observed that children labouring under sexual deformity are born earlier or later than those in which the sexual organs are perfectly developed. As an answer to this singular hypothesis, it may be observed, that of Dr. Murphy's two most protracted cases (Nos. 183 and 184, *post*, p. 625), the one was a female, and the other a male child.

Date of conception.—Another and very probable cause of the differences is that the date of conception is not the same after a single intercourse in different females. It is customary for physiologists to date conception from intercourse: but the researches of Bischoff and Raciborski have shown that a variable interval may elapse according to the situation of the ovum at the time. Bischoff believes that the ovum escapes from the Graafian follicle at the time when the menstrual discharge is about to cease; and he is of opinion, that to be fecundated, it must be acted on while it is in the Fallopian tube. Hence he considers, in order that impregnation should take place, that there must have been an intercourse within eight or twelve days from the cessation of the menstrual discharge: and in answer to the objection, that there are some women who become pregnant at any period, he considers that there is great uncertainty in the time at which the ovum leaves the ovary,— at which it enters the Fallopian tube, and how long a period it may take to reach the uterus, but that, as a rule, impregnation ensues shortly after the cessation of menstruation. (Med. Times and Gazette, April 8, 1854, p. 351.) Raciborski considers that the time is more limited. Out of sixteen women who gave him such information as enabled him to determine the time of fecundation, there was only one in whom this occurred so late as ten days after the cessation of the menstrual flux; and in this one, the menses had been suddenly arrested several days before the usual time of cessation, so that the extrusion of the ovum did not probably take place until about two days prior to the act of intercourse to which it owed its fecundation. (Baly and Kirkes's Recent Advances in Physiology, 1848, p. 58.) These authors also state that Naegele is accustomed to reckon the duration of pregnancy at nine months and eight days from the last menstrual period, and in normal cases he has found this to be correct. Dr. Oldham met with a case in which impregnation took place twelve days after menstruation: and he states that he has known it to occur at the respective times of ten days, twelve days, and ever twenty-one days after the monthly periods; and he knows of no fact to disprove the opinion that the human female is susceptible of impregnation at any time between her monthly periods. (Med. Gaz. vol. 44. p. 48.) In the same volume, at page 930, Mr. Kesteven has reviewed the theory of Bischoff at some length, and to his remarks I must refer the reader. According to Dr. Duncan, a single insemination at any period of the interval between two menstrual periods may result in the fecundation of a female. (Ed. Monthly Journal, 1854, vol. 9. p. 233.)

The experience of Dr. Oldham is confirmed by that of the late Dr. Reid. This gentleman admits that impregnation is more likely to occur immediately after the termination of a menstrual period, than at any time during the interval. The next most likely period is immediately previous to the occurrence of menstruation, and the probability of conception becomes slighter as the time is more distant from this epoch. According to Raciborski, from observations made in Paris of one hundred women, no more than six or seven had become impregnated at the mid-term from the menstrual periods. In the opinion of Dr. Reid, if we are to be guided by the number of days which have elapsed between the last appearance of the menses and parturition (this, however, he shows to be a most fallacious guide), there is no period in the menstrual interval at which impregnation may not occur. (Lancet, Sept. 3, 1853, p. 206.) In cases of single intercourse, the dates being certain, conception took place twelve and fourteen days after menstruation: several of these cases occurred within Dr. Reid's knowledge. It is here assumed, however, that conception is synchronous with intercourse. It may be therefore fairly taken as a fact, irrespective of any modern theories of ovulation, that a woman may conceive from intercourse had, at the inter-menstrual period (mid-period), although, in a given number of instances, it is probable that the conceptions would be more numerous within six or seven days after the cessation of the menses, than at any other period.

Recent physiological researches have proved that the date of *conception* is not fixed by the date of *intercourse*. The time occupied by the descent of the ovum along the Fallopian tube varies, while the time required for the passage of the male fluid to meet the ovum is also subject to variation. The investigations of Bischoff and Valentin show that the zoosperms may retain their movements, and probably their fecundating power for so long a period as *seven days* within the body of a female. Fecundation cannot result unless the matured ovum meets the zoosperms in a living condition; and conception may be regarded, in the language of Dr. Meigs, as the fixation of a fecundated ovum upon the living surface of the mother. These facts will account for some of the variations which are observed in the duration of pregnancy from a single intercourse. Conception may take place either in a few hours, or, according to Valentin's observations, for so long a period as seven days after intercourse. But they do not satisfactorily explain such extreme differences as were observed in the cases of Dr. Rigby and Dr. Reid (thirty-three days), or in those of M. Devilliers (forty-nine days), *ante*, p. 608. We must therefore be prepared to admit, either that conception may in some cases be delayed for so long a period as from five to seven weeks after intercourse, or that there may be a difference of from five to seven weeks in the duration of pregnancy. Whatever may be the explanation adopted, it is obvious that, in a medico-legal view, the only conclusion at which we can arrive is, that the period of gestation in the human female is *not*, as it was formerly supposed to be, a fixed and invariable term.

Great mistakes have arisen in the calculation of the period by the use of the word month—some intending by this a *lunar*, and others a *calendar* month. Nine lunar months would be equal to two hundred and fifty-two days, while the average of nine calendar months would be two hundred and seventy days—the latter period varying according to the particular months of the year over which the pregnancy may extend. To prevent such mistakes, or that misunderstanding of evidence which has so frequently arisen, it would be advisable that medical witnesses should always express the period of gestation in weeks or days. It would be also proper to adopt the plan of always commencing the calculation from the period of the last cessation of the menses, rather than from two weeks later. The latter rule is often followed, and this discrepancy creates confusion.

Premature births. Short periods of gestation.—From the preceding remarks we may regard all births before the thirty-eighth week as premature, and all those which occur after the fortieth week as protracted cases; and one great point for a medical witness to determine is, whether the characters presented by a child correspond to those which it should present, supposing it to be legitimately born. When the birth is premature, this sort of corroborative evidence may be sometimes obtained; because, assuming that there has been no access between the parties before marriage, children born at the fifth, six, or even seventh month after marriage, cannot, if the offspring of the husband, present the characters of those born at the full period. It is not so with protracted births; for children are not more developed in protracted cases, than they are in those which occur at the usual period. (For an account of the characters presented by children at different uterine ages, see *ante*, pp. 415, 558.)

In judging from the *marks of development* on the body of a child, we must make full allowance for the exceptions to which they are liable. The nearer the supposed premature delivery approaches to the full period of gestation the more difficult will be the formation of an opinion. Although the characters of a seven months' child are usually well marked, and may be known by common observation, it is not easy to distinguish a child born at the eighth from one born at the ninth month. Burns observes that it is possible for gestation to be completed, and the child perfected to its natural size, a week or two sooner than the end of the ninth month; and other accoucheurs corroborate this view. In a series of cases which occurred to M. Devilliers, the following were the weights of children born at the respective periods:—

229 days . .	4·60 pounds av.	270 days . .	6·8 pounds av.
246 „ . .	4·88 „	272 „ . .	7·3 „
257 „ . .	6·68 „	283 „ . .	6·0 „
267 „ . .	7·71 „		

Hence the weight of a child born in the fortieth week may be less than that of another born in the thirty-seventh week of gestation. The weight in the third case may be taken as the average weight of a mature child, and the delivery took place *three weeks* before the usual period. (See Gazette Médicale, 4 Mars 1848, p. 168.) Thus, then, a child born at the eighth month may be the offspring of the husband:—at the ninth, of an adulterer; but medical facts could not enable a witness to draw any distinction. It is here that moral proofs are necessary; for without these, the legitimacy of a child, in such a case, could not be successfully disputed. With respect to twin children, the greatest differences are sometimes observed. In a case which occurred to Mr. West, the first child born weighed only a pound and a half; the second weighed more than three pounds, and both lived several hours. The uterine age must have been the same. In another premature twin case which occurred to the same gentleman, one child weighed two pounds and a quarter, and the other two pounds and three quarters. (Med. Times, Feb. 23, 1850, p. 147.)

The *survivorship of a child* has been supposed to furnish additional evidence; for, it is well known, that under a certain age children are not born living, or if living, they speedily die. Therefore it has been argued, if a child born at the fifth or sixth month after the first cohabitation, be born living or survive, this should be taken as a proof of its illegitimacy. The following remarks will, however, show that an argument of this kind may be overstrained.

Viability. Earliest period at which a child may be born living.—According to the English law, it is not necessary that a child, when born, should be capable of living, or *viable*, in order that it should take its civil rights. Thus it may be born at an early period of gestation:—it may be immature, and not likely to survive: or again it may be born at the full period of pregnancy, but it may be obviously labouring under some defective organization, or some mortal disease, which must necessarily cause its death within a short time after its birth. Fortunately, these points are of no importance in relation to the right of inheritance: an English medical jurist has only to prove that there was some well-marked physiological sign of *life* after birth (p. 588),—whether the child were mature or immature, diseased or healthy, is a matter which does not at all enter into the investigation. In this respect, our law appears to be more simple and just than that which prevails in France. By Art. 725 of the Code Napoléon, no child that is born alive can inherit, unless it is born, as the law terms it, *viable*. The meaning of this word is not defined by the law itself, and there are probably no two lawyers, or physicians in that country, who place upon it the same interpretation. The French law seems to intend (Devergie, vol. 1. p. 700; Briand, p. 173), by viability in a new-born child, that it should be capable of living out of the womb of its mother, and independently of her;—also, that it should be capable of living for a longer or shorter period after its birth. It would have been difficult for any system of jurisprudence to have laid down a more vague or incorrect principle than this; and medical witnesses may consider themselves fortunate, that in this country they have not to take part in the litigation to which such a principle must necessarily give rise. The effect of the French law is this:—a child may be born alive: it may breathe and cry, and survive its birth for some considerable time: yet upon arbitrary medical principles, founded upon the period of gestation at which the child is born, on its length, its weight, the colour of its skin, the length of its hair, and form of its nails, it may be pronounced not viable; *i. e.* not capable of inheriting and transmitting property! But then, again, the child may be externally pronounced viable, and live four or five days: yet, on inspecting the body after death, if disease of the lungs, brain, or any organ, which had its origin previous to birth, be found, it will be pronounced the contrary, and the rights of property are thus made to rest upon the most trivial and unsettled conditions. The presumption is, however, in favour of the legal rights of the offspring, when it has been clearly proved that it has lived after it was born. The viability of the child is presumed, and those who would then benefit by the allegation of non-maturity, must prove it. (Briand, Man. Complet de Méd. Lég. 1846, p. 173.)

It may at first sight not appear quite consistent with justice, that a child which is born immature, or labouring under disease, owing to which it cannot long survive its birth, should possess the same rights of inheritance as the one which is born mature and perfectly healthy; but this evil to society, if it be admitted as such, is of far less magnitude than the adoption of a system which must constantly lead to subtle casuistical distinctions, and thereby create error and confusion. So long as there is no well-defined line, between a child which is considered capable of living, and one which is not, gross injustice must necessarily be inflicted by any rule of law similar to that which is admitted in the Code of France. In a recent case an attempt was made to push the doctrine of non-viability to such a degree as actually to include cases of injury inflicted by instruments during delivery; so that by the awkwardness of an accoucheur in the use of the forceps, a well-formed healthy child might, by reason of its death soon after birth, be pronounced *non-viable.* M. Tardieu was consulted in a case of this kind, and by his medico-legal experience he was enabled to satisfy the parties concerned, that the child was perfectly *viable* in a medical sense, and that its death had arisen not from any congenital disease or malformation, but from injuries inflicted by the instruments which were necessary to aid delivery. (Ann. d'Hyg. 1853, vol. 2. p. 193.)

The question to be considered is,—What is the *earliest period* at which a child can be born, to enable it to live and to continue in life after its birth? It is now universally admitted, that children born at the seventh month of gestation are capable of living, although they are more delicate, and in general require greater care and attention to preserve them, than children born at the ninth month:—the chances are, however, very much against their surviving. It was the opinion of Dr. William Hunter, and it is one in which most obstetric authorities concur, that few children born *before the seventh month* are capable of arriving at maturity. They may be born alive at any period between the sixth and seventh months, or even, in some instances, earlier than the sixth: but this is rare, and if born living, they commonly die soon after birth. There is one case on record, of a child having been born living so early as the *fourth month* of gestation (Brit. and For. Med. Rev. vol. 2. p. 236); and another of recent occurrence, in which a female aborted at the fourth month and a half of pregnancy. M. Maisonneuve was not called to this case for two hours; he then found the fœtus in its membranes, and on laying these open, to his surprise it was still moving. He applied warmth, and partially succeeded in restoring it; for in a few minutes the respiratory motions were performed with regularity, but the child died in about six hours. (Journal de Médecine, and Med. Gaz. vol. 39. p. 97.) In two instances of abortion about the *fifth* month, Dr. Davies, of Hertford, noticed that the fœtus showed signs of life after its birth, by moving its limbs (Med. Gaz. vol. 40. p. 1022); and the following case, in which a child, born at the *fifth* month, survived upwards of twelve hours, is reported by Mr. Smythe. A female in her second pregnancy, and in the 147th day of gestation, had severe flooding with rupture of the membranes. Labour occurred on the following night, when a small but well-formed fœtus was expelled, giving no other indication of life than a feeble action of the heart, and a strong pulsation in the umbilical cord. It was resuscitated, and *cried* as strongly as a child born at the full period of pregnancy. It weighed less than two pounds, and measured exactly twelve inches. It swallowed some nourishment, but died about twelve hours after birth. The membranæ pupillares were entire,— the testicles had not descended,— the head was well covered with hair. The length and weight, as well as the presence of hair, indicated a fœtus between the sixth and seventh months; but, as it is alleged by the reporter, that from peculiar circumstances the mother of the infant was correct in the dates, we are compelled to infer that this was an extraordinary case of premature development. There was clearly nothing in the organization of this child to have prevented its growing to the age of maturity: in other words it was *viable*. (Med.-Chir. Rev. July 1844, p. 266.) Another case is reported, in which a child born at five months and a half survived its birth between three and four hours Med. Gaz. vol. 19. p. 865); and on a trial for child-murder (*Reg.* v. *West*, Nottingham Lent Assizes, 1848), a midwife was indicted for causing the death of a child, by bringing about the premature delivery of the mother, when she was between the fifth and sixth months of pregnancy. The child in this instance lived five hours after its birth. Capuron mentions an instance in which a child was born at the sixth month and a half of pregnancy, and at the time he reported the case, the child was two years old and enjoyed excellent health. In another instance, a child was born at the same period, and lived to the age of ten years. (Méd. Lég. des Acc. pp. 162, 208.) In a case which fell under my own knowledge, a child was born at the sixth month and a half of gestation, and lived a fortnight (See another case, Med. Gaz. vol. 32. p. 623.) Capuron considers that a child born at the 180th day, or at the sixth month after conception, may be sufficiently mature to live; *i. e.* that there would be no reason to presume that it was illegitimate, merely because it survived its premature birth. On the other hand, if born before the sixth month with sufficient maturity to live, this fact, although by no means a proof, affords, in his opinion, a strong presumption of its illegitimacy. Of eight cases of children born living (by abortion) at the sixth month, Mr. Whitehead states that seven perished within six hours after birth, and one only attained to the age of ten days. (On Abortion, p. 249.) Dr. Rüttel, who has examined the subject with great care, states, as the result of his experience, that he attended a married woman, who was afterwards delivered of a living child in the *fifth month* of her pregnancy. The child survived its birth for twenty-four hours. He delivered another woman in the *sixth month* of her pregnancy, of twins—one was dead, and the other continued alive for three hours, its life being indicated only by the visible pulsation of the heart: there was no perceptible respiration. This fact corroborates the remarks made elsewhere, as to life without active respiration, in cases of infanticide (*ante*, p. 438); it has also an immediate bearing on the proof of life in reference to tenancy by courtesy. (Cases of *Fish* v. *Palmer*, and *Brock* v. *Killock*, pp. 588, 591.) In another instance of the birth of male twins at the *sixth month*, each weighed three pounds. Dr. Rüttel saw them a year after their birth, and they were then two healthy strong children. (Henke, Zeitschrift der S. A. 1844, p. 241.) Dr. Barker, of Dumfries, met with a case, in which a child was born at the 158th day of gestation, or twenty-two weeks and four days after intercourse. The size and weight of the child corresponded with the period at which it was born. It weighed one pound, and measured eleven inches. It had only rudimentary nails, and very little hair, on the back of the head. The eyelids were closed, and remained closed until the second day. The nails were hardly visible; the skin was shrivelled. The child did not suck properly till after the lapse of a month, and she did not walk until she was nineteen months old. When born the child was wrapped up in a box, and placed before the fire. Three years and a half afterwards this child was in a thriving state and healthy, but of small make. She weighed twenty-nine pounds and a half. (Med. Times. Sept, 1850, p. 259; also Oct. 12, p. 392.) Mr. Annan, surgeon, of Kinross, has recorded a case in which a child was born between the end of the sixth and the middle of the seventh month, and lived for a period of four months and eight days. It weighed a pound and a half when seven days old. (Med. Times, Sept. 9, 1848, p. 304.) In a case which occurred to Dr. Outrepont, of Bamberg (reported in Henke's Zeitschrift, vol. 6), there was the strongest reason to believe that gestation could not have exceeded twenty-seven weeks. The child (a male) weighed, when born, one pound and a half, and measured thirteen and a half inches. The skin was covered with down and much wrinkled—the limbs were small—the nails appeared like white folds of skin, and the testicles had not descended. It breathed as soon as it was born, and by great care its life was preserved. It is singular that its development was very slow until it had reached a period which would have corresponded to the forty-second week of gestation. Dr. Outrepont saw the child when he had attained the age of eleven years, and then he appeared to be of the size of a boy of eight years.

The only remarkable point about the case is the length of time which the child lived. In a case quoted in the Lancet, Aug. 23, 1851, p. 177, a child born at six months and ten days was thriving satisfactorily when four months old. (See also Med. Times, Feb. 16, 1850, p. 129.) A gentleman of a well-known family in Scotland was undoubtedly born before the seventh month. When first born, the child weighed three pounds. As a child he was not expected to live, but he grew up a small strong man, capable of great mental and bodily exertion: he died from natural causes at about the age of forty-two. His head throughout life was large in proportion to his size. It is therefore clear, that children born at the seventh, and even at or about the sixth month, may be reared, and that the fact of their surviving for months or years cannot be taken as evidence of illegitimacy. In forming a judgment on these occasions, we are bound to look less at the *period* at which the child is born than at the marks of *development* about its body. The case of Mr. Smythe (p. 616) is corroborative of this view. Such, I believe are the principal medical facts connected with the question of *premature birth*; and the following singular case will serve as an illustration of the difficulties sometimes experienced in forming a medical opinion.

The Kinghorn case.—In October 1835, an investigation (*fama clamosa*) took place before one of the Presbyteries of Scotland, in reference to certain reports which had been circulated, to the prejudice of a minister of the district. It appears that the marriage of this gentleman took place on the 3d of March, and his lady gave birth to a female child on the 24th of August following; *i.e.* one hundred and seventy-four days, or nearly *six calendar months*, after the marriage, and the child continued to live until the 20th of March, 1836. When born it was very weak, and, according to the evidence of the accoucheur and others who saw it, it was decidedly immature. The birth of a living child, together with the fact of its surviving for so long a period, led, however, to the report that there must have been intercourse between the parties previously to the marriage. It was contended that the period was too short for the child to have been begotten in wedlock. Dr Hamilton, of Edinburgh, on being applied to by the Presbytery, said that his own experience was opposed to the probability of a child born at the sixth lunar month surviving (the time in this case was six lunar months and six days); but he referred to two cases, in which children born under similar circumstances had survived their birth for a long period. In one, the lady was delivered within five lunar months (twenty weeks) after the marriage, and Dr. Pitcairn and others gave it as their opinion, that it had been begotten within wedlock: in the other, a woman gave birth to a child nineteen weeks after conception, and it lived a year and a half. Dr. Thatcher, who examined the child in the case here reported, nineteen days after its birth, gave it as his opinion that it might have been begotten on or after the 3d of March; and the circumstance of its having been reared in the premature state in which it was born on the 24th of August following, was no objection to this opinion. He considered the complaint made against the minister groundless. The case went through several appeals, and was not finally decided until May 1839, when the libel was found *not proven*, and the defendant was absolved from censure. Many medical witnesses gave evidence on the occasion:—the majority of them were strongly in favour of this having been a legitimate and premature birth. (See Record of Proceedings, &c. Edinburgh, 1839; Med. Gaz. vol. 17. p. 92; also Med.-Chir. Rev. vol. 31. p. 424.) Although not connected with the medical part of the case, it should be observed, that the character of the parties was free from all suspicion, that no concealment had been practised by them, and that no preparation had been made for the early birth of the child. There were, it is true, *unusual marks of development* about the child, considering the early period of its birth; yet these were not sufficient, any more than the fact of its surviving, to induce the belief that it had been begotten out of wedlock. One case has been already mentioned in which a child born at a still earlier period, survived several hours, and others in which children born rather later, lived for two and ten years. It would be in the highest degree unjust to impute illegitimacy to offspring, or a want of chastity to parents, merely from the fact of a six months' child being born living and surviving its birth. There are, indeed, no justifiable medical grounds for adopting such an opinion,—a fact clearly brought out by a question put to Dr. Campbell, the chief medical witness in favour of the alleged antenuptial conception. In his examination in chief, he admitted that he had himself seen the case of a six months' child who had survived for *several days*. He was then required to say, whether he could assign any reason why, if after such a period of gestation it is possible to prolong life for *days*, it should not be possible to extend it to *months!* He could obviously give no reason. (Record of Proceedings, &c. 55.)

The great injury which may be done by speculative medical opinions, such as those given against the chastity of the parties concerned in these proceedings, will be apparent from the record of a case which occurred to Dr. Halpin, of Cavan, in 1845:—A healthy woman, æt. thirty-four, the mother of five children, was delivered in the *sixth month* of her pregnancy of a female child. It was rolled in flannel, and laid in a warm place. Contrary to expectation, the child survived, sucked vigorously, and was healthy in every respect. The ossification of the bones of the head was very imperfect, and the sutures broad enough to admit of the middle finger being laid between them; and the fontanelles were of correspondingly large size. The weight of the child, on the fourth day after birth, was two pounds thirteen ounces; and on the thirty-fourth day, three pounds seven ounces. The child was alive and well when last seen on the 4th of March,—*i. e.* four months after birth: she then weighed eight pounds eight ounces. After this, Dr. Halpin lost sight of her, as the mother left that part of the country. (Dublin Quarterly Journal, May 1846, p 563. See also Dr. Barker's case, *ante*, p. 617.) If the facts of these cases be compared with those of the Kinghorn case, it will be seen that there were no just medical grounds for the allegation that the child had been begotten out of wedlock. In these two cases six months' children were living and healthy after four months and three years and a half, respectively: in the Kinghorn case, it was supposed that the child must have passed the sixth month (of uterine life), because it had survived seven months! In Dr. Halpin's case, the child, four days after birth, weighed two pounds thirteen ounces—(a sixth months' child rarely exceeding two pounds): in the Scotch case, it was considered that it must have been much beyond the sixth month, because (a fortnight after its birth) it weighed three pounds! These cases should be borne in mind, when much reliance is placed upon the appearance presented by children as positive evidence of the state of uterine life which they are supposed to have attained.

Evidence from the state of development of the offspring. The fact that a child born at nine months is small, and resembles in size and weight a seven or eight months' child, cannot be taken as a proof of illegitimacy. It has been already stated, that children born at the full period vary considerably in size and weight; yet, although small, there are commonly about them the appearances of *development*. This is especially apparent in the features. If there be a general want of development in the body, and if certain fœtal peculiarities remain,—as for example, the membranæ pupillares, or, in the male, the testes do not occupy the scrotum, these facts may lead to a strong presumption that the child has not reached the full period. On the other hand, when a child is born with all the signs of maturity about it, at or under seven months (from possible access of the husband), then there is the strongest reason to believe that it is illegitimate. No instance is recorded in which children have reached maturity two months earlier than the natural period. There are many cases of retarded development: but, so far as I know, this kind of premature development in the fœtus has never been observed. In the Scotch case above related, the child was more developed than such children commonly are at the same period of uterine life: but the differences were slight. The great progressive stage of development is during the two last months of gestation: the changes which the fœtus undergoes are greater and more marked, at this than at any other period. At eight months there might be some difficulty in forming an opinion; but it appears to me, that at seven months it would be impossible for an accoucheur to commit an error on this point. If the body of a child was large and fully developed, he would consider it to have been born at the full period of gestation, and attribute any opinion which had led to the supposition that it was a seven months' child to have arisen from some mistake in the calculation. Dr. Beck states it as barely possible that a child born at seven months may *occasionally* be of such a size as to be considered mature, yet he qualifies this statement by the remark, that the assertion is most frequently made by those whose character is in danger of being destroyed. The question is, however,—Has a really seven months' child ever been born so developed as to be mistaken by an experienced person for one that was mature? He adduces no case of this kind in support of his opinion. There can be no doubt of the correctness of his statement, that a *mature* child, born *before* seven full months after intercourse, ought to be considered illegitimate: but it would be difficult to maintain this position, consistently with the above admission; a child is as likely to acquire premature development during the latter half of the sixth as at the seventh month. In making this remark, I ought to mention that Dr. Rüttel, an experienced observer, has met with several cases in which females have been delivered two and even three weeks before the expiration of the ordinary term (two hundred and eighty days), and the children were as perfectly developed, to all appearance, as those born at the full period. (Henke, Zeitschrift, 1844, p. 246.)

The following case in reference to development has been communicated to me by one of my pupils. It is well calculated to show the characters of a seven months' child, and to corroborate the views adopted by physiologists respecting the means of determining the period of uterine life which the fœtus may have reached. Mrs. F. was married on the 7th April 1846, and was delivered by my informant of a male child at seven o'clock on the evening of the 19th October following,—the period of gestation being equal to 195 days, or twenty-eight weeks. The infant cried strongly, and lived until nine o'clock the following morning. The skin was of a deep pink or rose colour, beautifully soft, and covered with a fine down. The membranæ pupillares were absent, and the pupils were well formed,—the nails were complete,—the testicles had *not* descended into the scrotum,—the length of the body was fifteen inches, and its weight, two pounds eight ounces. Its weight, and the non-descent of the testicles, at once referred it to a uterine age of seven months.

In addition to the other circumstances mentioned, it is observed that children at the seventh month do not so readily take the breast as those which have reached the ninth; and their power of sucking is much more feeble.

When the facts are such, that to be the offspring of the husband it must be a *six months'* child, and it is born *mature*, there can be no room to doubt its illegitimacy. This question was raised in the Exchequer Sittings (January 1847), on a motion for a new trial in the case of *Eager* v. *Grimwood*. The action was one for seduction, and the principal witness in the cause, a young female, on being cross-examined, stated that she was first connected with the defendant a few days before Christmas 1845, and that the birth of the child took place in the June following—*i. e.* in about six calendar months. Under these circumstances, as the child appeared to have been full-grown, the Chief Baron, assuming the statement of the dates to be correct, intimated it to be his opinion, that the action could not be maintained, as the foundation of it was the loss of service, arising from the defendant's intercourse with the daughter, and her subsequent confinement; and that it was impossible that he could have been the father of the child in question. The jury found for the defendant. A rule for a new trial was granted, chiefly on the ground that the woman had, from confusion in giving her testimony, made a mistake in the period. This question may arise in cases of divorce, and the fact be received as proof of the act of adultery. In the case of *Maclean* (House of Lords, March 1851), it was proved that the earliest intercourse which could have been had with the husband was on the 22nd December, 1847; while according to the medical evidence the child was born on the 6th July 1848, and was a full-grown nine months' child. This was received as proof of adultery on the part of the wife. In *Heathcote's* case (March 1851), it was proved that the husband returned on the 24th November, 1849, and the wife was delivered of a full-grown child on the 18th May 1850. This was also taken as proof of the alleged adultery. In *Hawkins's* case, May 1852, it was proved that there had been no access of the husband, owing to his absence between the 16th May 1850, and the 23rd March 1851. A full-grown and *mature* child was born on the 2nd June, 1851: hence, to have been the child of the husband, gestation must have been extended to a year and sixteen days, or reduced to a period of only seventy-one days. This was taken as clear proof of adultery on the part of the wife. It is to be remarked of this case that the husband had slept with his wife after his return, even up to five minutes of the time of her delivery, without suspecting his wife's pregnancy; and her female attendant, who had been in the habit of seeing her daily, did not observe any alteration in her personal appearance. This created a little difficulty in the case: but it merely serves to show either that a visible prominence of the abdomen is by no means a constant accompaniment of the pregnant state, or that it may be easily concealed.

Protracted births. Long periods of gestation.—The questions connected with retarded gestation have given rise to considerable discussion in legal medicine. That gestation may be retarded or protracted beyond the fortieth week, is now, I believe, not disputed by any obstetric writer of reputation. Some accoucheurs have denied it, because they have not met with such cases; but the medico-legal relations of such questions do not depend upon the solitary experience of practitioners. It is only by the accumulation of well-ascertained facts from all authentic sources that medical knowledge can be made available to the purposes of the law: otherwise, owing to the mere accident of a witness not having met with any exceptional case, a Court may be entirely misled in its judgment by trusting to his opinion. It is the more important to attend to this, because most of the cases involving questions of contested legitimacy, or the chastity of females, turn upon protracted, rather than upon premature, delivery.

In the standard works on midwifery will be found authentic reports of cases in which gestation continued to the forty-first, forty-second, forty-third, and even the forty-fourth week. Dr. Murphy regards 301 days, or forty-three weeks, as the average limit of gestation. (Obstetric Report, p. 4.) Dr. Lee met with a case in which he had no doubt that the pregnancy lasted two hundred and eighty-seven days:—the labour did not take place until forty-one weeks after the departure of the husband of the lady for the East Indies. (Med. Gaz. vol. 31. p. 917.) Dr. William Hunter met with two instances in which gestation was protracted until the forty-second week. Dr. Montgomery met with a case in which delivery did not ensue until between the forty-second and forty-fourth week. (Med. Gaz. vol. 19. p. 646.) Dr. Merriman has published a valuable table on the subject of protracted gestation, on which the most experienced accoucheurs have been in the habit of relying. Of one hundred and fourteen pregnancies calculated by him from the last day at which the females menstruated, and in which the children appeared to be mature, the following were the periods:—

In the 37th week	3	In the 41st week	22
38th	13	42nd	15
39th	14	43rd	10
40th	33	44th	4

Another well-marked case, occurring forty-four weeks precisely after the cessation of the menses, has been communicated to me by Dr. S. W. J. Merriman.

From these results Dr. Merriman considers that in the greater number of women, gestation is completed in the fortieth week from the cessation of the menses, and next to this period in the forty-first. In the evidence given by this gentleman before the House of Lords in 1825, the case of longest protraction on which he was able to rely, was that of a married female, who was in the habit of calculating from the last day on which her monthly period ceased. This lady was delivered 309 days, or forty-four weeks and one day, from the time at which she supposed that she had conceived. In another case mentioned by the witness the period was 303 days, or forty-three weeks and two days from the termination of the last monthly period. It was objected to this evidence by the Attorney-General that it was impossible to fix the exact date of conception, and as the female might have really conceived only a day or two before the expected return of menstruation,—twenty-eight days, or four weeks, should be deducted from the periods assigned by the witness. Admitting the validity of this objection,—and the fact upon which it is based is indisputable,—it followed that the longest protracted case observed by Dr. Merriman might have really been only a case of ordinary gestation extending to forty weeks and one day. An objection of this kind may of course be successfully urged in law to any inference from a calculation so made, and it was thus that in the Gardner Peerage case, the medical evidence failed to render it certain that gestation might be so protracted as to support the legitimacy of the claimant. It is therefore obviously of the greatest importance, in considering this question, to make full allowance for a possible error; and in calculating the pregnancy from the last day of the last menstrual period, to deduct the interval of menstruation, if known, and at least twenty-eight days if unknown. It must be remembered, that in these cases of contested legitimacy the offspring is commonly the result of a *single* intercourse. The date of conception is therefore fixed within limits already described (*ante*, pp. 607, 612), and a comparison can be instituted only between the period of gestation thence deduced, and the periods taken in other cases which are equally free from any error.

A well-marked case of gestation passing beyond what is commonly set down as the average period, has been communicated to me by Mr. Howell, of Walton-on-Naze. This occurred in a healthy female, æt. 30, who had borne three children, the youngest being four years old. She had menstruated with regularity up to the third week in June: the menses then stopped without any apparent cause. Her delivery took place 323 days after the last appearance of the menses. Allowing that impregnation occurred at the inter-menstrual period, this would make the gestation 309 days; or assuming that impregnation did not occur until twenty-eight days from the date of the last menstruation, this would make the period 295 days, or forty-two weeks and one day. Dr. Murphy, of University College, has also furnished me with some facts in reference to this subject. Out of 182 cases in which special inquiries were made of the females, the deliveries took place from the date of the last appearance of the menses at the following periods in weeks. The details are given in his Report of the Obstetric Practice of University College Hospital for 1844.

In the 33rd week	5	In the 40th week	25
34th	3	41st	32
36th	6	42nd	25
37th	11	43rd	19
38th	12	44th	9
39th (9 months)	24	45th	11

The most protracted of the cases in the table was No. 182. The period of gestation was 329 days, or deducting twenty-eight days (the ascertained menstrual interval), 301 days, or forty-three weeks; *i. e.* three weeks beyond the usual period, or that allowed by the medical witnesses who gave evidence against the possible protraction of pregnancy in the Gardner Peerage case.

It will now be proper to direct attention to some still more protracted cases which are recorded by writers of repute, and which have either fallen under their own observation, or under that of friends upon whose judgment they could rely. Among these a case is reported by Dr. Beck to have occurred in America in 1840, in which gestation is stated to have extended to 313 days, or forty-four weeks and five days; but, as the facts are not fully detailed, I prefer taking for illustration two cases observed by Dr. Murphy, and recorded in his Obstetric Report for 1844. He states that No. 183, a healthy married woman, aet. 26, pregnant with her third child, was delivered 342 days from the last appearance of the menses. The date at which they were last observed by her was the 1st September, and the woman was delivered on the 9th August of the following year. In No. 184, a married woman, aged 33, pregnant with her fifth child, delivery took place at an interval of 352 days. The menses last appeared on the 1st of March, and the child was born on the 16th of the following February. In both instances the menstrual interval was observed to be four weeks; therefore, deducting twenty-eight days, the periods of gestation in these two cases will be—

No. 183	(342−28)	314 days	44 weeks and 6 days
No. 184	(352−28)	324 ,,	46 ,, 2 ,,

As these cases are of an unusual kind, the facts are specially detailed. Dr. Murphy observes, in respect to the longest, "that the date of the last menstrual discharge in this, as in other cases, was recorded *before* parturition took place; thus preventing the possibility of misstating this fact for the purpose of making it appear that gestation was inordinately prolonged. Menstruation, however, is sometimes suspended, or may return at irregular intervals during pregnancy; it was possible, therefore, that the menses might have appeared in this irregular way, occurring but once, and that time being put two months before conception. It was necessary to avoid this source of error. This irregularity did not take place in either of the cases, and in the last instance there was an interval of four years between the present and the previous pregnancy, during the whole of which period to the time of conception the menses were quite regular." (Report, page 7.) Dr. Murphy has since published a case which occurred in his practice in 1849: the duration of pregnancy was 351 days, or, deducting the monthly period (351 — 28), 323 days. (See Med. Gaz. 1851, vol. 48. p. 683.) These cases have been strongly objected to by some accoucheurs as being based on the cessation of the menses, a condition which, as it has been already stated, has given rise to numerous errors of calculation. I have, however, retained them on Dr. Murphy's authority. Dr. S. W. Merriman has given me a reference to a case which goes one day beyond the longest of Dr. Murphy's, *i. e.* 325 days, or forty-six weeks and three days. This is reported by Dr. Power, in his work on Human Pregnancy. Mr. Chattaway, of Knighton, a former pupil, has communicated to me a remarkable case of protracted gestation, which tends to support the observations of Dr. Murphy and others. A healthy woman, æt. 36, the wife of a farmer, applied to him to attend her in her confinement, which she expected to take place in September 1856. The menses appeared for the last time in December 1855, and she quickened in the beginning of April 1856. About the middle of September (*i. e.* on the 283rd day, dating from the last menstruation), Mr. Chattaway was summoned to attend her, and he found her labouring under severe false pains. There was also a discharge of mucus tinged with blood. The case went on until Nov. 19th, 1856, when the patient was delivered of a female child of the average size. It would thus appear, according to the ordinary mode of calculation, that deducting twenty-eight days from the last appearance of the menses, gestation was protracted in this instance to 330 days, or forty-seven weeks and one day.

These cases, assuming the facts to have been correctly observed and reported, meet the objection taken to Dr. Merriman's evidence in the Gardner Peerage case. All women may not have such unusually protracted pregnancies; indeed, it is well ascertained that no two women are alike in this respect, and that two successive pregnancies in the same female are rarely alike in duration. Then, again, all practitioners may not have met with such protracted cases. The fact being clearly ascertained in one case, renders it unnecessary to search for more, unless we doubt the credibility of a reporter well qualified to observe, and who could have had no motive to serve but that of stating a plain truth as it came before him. On this part of the question I think it is unnecessary to argue. The advocates of a fixed and limitable period differ from each other by a space of at least ten or twelve days, and each must either take his own experience for the final decision of this question, or it must be allowed that men of equal powers of observation with themselves, have met with cases which have gone beyond their own fluctuating limits.

Dr. Murphy has so completely anticipated the objection which might be urged on the ground of the menstrual function being possibly suspended from some hidden morbid cause one or two months before the actual date of conception, that it is scarcely necessary to make any remarks upon it. If it is to be admitted under these circumstances, it would be only equally just to admit that in any given case the ordinary and so-called fixed period, calculated from the cessation of menstruation, is based on a fallacy. Thus, it might be urged the menstrual function may continue for several intervals after conception. A woman may have conceived one or two months before the cessation of the menses, and thus a corresponding addition should be made to the ordinary period. Dr. Murphy observes of his cases, that periodic discharges resembling the menstrual took place during pregnancy: in one case up to the *time of quickening*, and then ceased; in another up to the *eighth month* after conception; in a third throughout the *whole period* of pregnancy. In all these cases the discharge was described as being in every respect similar to the menstrual. This view of the question may appear to prove that no reliance can be placed on the time of the cessation of the menses as evidence of the duration of pregnancy; but if, as in case No. 184, a married woman has been perfectly regular for four years previously, the sudden cessation of the discharge without any morbid cause to account for it, would assuredly furnish evidence of the strongest possible kind. Its continuance may, on the other hand, give rise to error, and lead to the period being unduly shortened. In the Gardner Peerage case, the Attorney-General was quite willing to rely upon the cessation of the menstrual discharge as a good criterion of the duration of pregnancy, when by such a mode of calculation this was not made to exceed forty weeks! But this condition must be either taken or rejected altogether as evidence: if taken, we have no right, in alleged protracted cases, to refer the suppression to disease, for the sake of shortening the period, —when in ordinary cases we do not refer its continuance to disease, because this would tend to lengthen it: if rejected, it would be in the highest degree unjust not to give to a claimant the beneficial presumption of his having been born legitimate, when the cases adduced in evidence against his claim are actually based upon a precisely similar mode of calculation!

It is impossible to admit that the whole of the protracted cases recorded by different observers, have depended upon some mistake being made in the calculation of the period, since this calculation was founded on the same principles as those adopted in cases of ordinary pregnancy. Hence, if there was a mistake in the one case, there would be in the other: if an error in the exception, there would be an error in the rule. Either the average term of pregnancy is wrongly calculated by most accoucheurs at the thirty-eighth or fortieth week, or it is rightly calculated to extend occasionally to the forty-fourth, or, admitting Dr. Murphy's case, to the *forty-sixth* week. But even setting aside the palpable answer to an objection of this nature, some of the cases observed were instances of impregnation from a single intercourse; and making due allowance for the interval for conception, the general inference would not be affected, and no fallacy could have arisen in these cases from mistakes regarding menstruation.

Since the publication of the early editions of this work, some instructive papers on the duration of pregnancy have been published by the late Dr. Reid. (See Lancet, Sept. 3 and 10, 1853, pp. 205 and 235.) The conclusions at which Dr. Reid has arrived are adverse to the views of Dr. Murphy regarding the great duration of pregnancy. He states truly, that an accidental arrest of the menstrual discharge may take place for three, four, or many successive periods, while impregnation may have occurred at any time during this suspension. Under these circumstances, a calculation based on the date of the suspension of the discharge would, of course, be erroneous; and "the number of days which elapse after the last menstrual appearance, is not, therefore, *any proof* of the real extent of gestation in otherwise doubtful cases." In one case which he reports, labour occurred 294 days after menstruation, but 278 days after intercourse; in a second, 287 days after menstruation, but 276 days after intercourse; in a third, 281 days after menstruation, but 277 days after intercourse; and in a fourth 294 days after menstruation, but 279 only from the earliest possible time of conception (intercourse). It will be perceived that while the dates from intercourse varied slightly, those from menstruation varied considerably. In a case reported by Dr. Montgomery, the last menstruation was on the 18th of October. Impregnation (intercourse?) took place on the 10th of November, and parturition followed on the 17th of August. The interval between insemination (intercourse) and parturition was thus 280 days, and between the last menstruation and parturition it was about three weeks more, namely, 303 days.

Dr. Reid's conclusions, derived from the facts and cases published in his papers, present the recent views of an experienced observer on this much disputed question: They are, 1. "The duration of pregnancy is not altogether a fixed period. It varies somewhat in the human female as it does in the lower orders of animals. 2. This deviation, however, is not to any great extent. The only *certain* data for calculation are those dependent on the *known time of conception* (of *intercourse?*). 3. The *average* duration of the pregnant state, when calculated from this event, is about 275 days, or it may have a range of from 270 to 280 days. 4. There is no full or satisfactory evidence of gestation having been prolonged beyond 293 days. 5. The Code Napoléon, which allows 300 days, and the Prussian law, which fixes the *ultimum tempus* at 301 days, may be regarded as liberal. 6. The menstrual period must generally serve as our guide in default of some exact knowledge. It is, however, often fallacious, and is only a means of approximation as to the probable time of parturition. 7. The fortieth week after the last appearance is the most likely period, and the forty-first the next."

Dr. Duncan (Ed. Monthly Journal, 1854, vol. 9. p. 230) draws the following conclusions regarding the duration of pregnancy. 1. That the interval between conception and parturition (the real duration of pregnancy) has not been exactly ascertained in any case. 2. That the average interval between insemination (intercourse) and parturition (commonly called the duration of pregnancy), is 275 days. 3. That the average intervals between the end of menstruation and parturition, have no standard length, but vary within certain limits. 4. That while absolute proof of the prolongation of real pregnancy beyond its usual limits is still deficient, there is evidence to establish the probability that it may be protracted beyond such limits to the extent of three or even four weeks.

It will be perceived from the conclusions drawn by Dr. Reid that he admits a variation of 23 days, *i. e.* from 270, the shortest period, to 293, the longest known to himself from a single intercourse. (See *ante*, p. 607.) There appears to be no reason why the variation should not be even greater than that which is here assigned, and why the duration of pregnancy should not extend occasionally to 296 and 301 days. (See cases, *ante*, p. 625.) It is merely a question of individual experience. An accoucheur who admitted a variation of 23 days, and who had known gestation to be protracted to the 293rd day after intercourse, would hesitate to pronounce a child illegitimate merely because it had been born on the 296th or the 300th day after possible access of the husband. There is no doubt a limit to gestation, but it is not in our power to fix it: hence we find obstetric writers of repute adopting periods which have no point of agreement among themselves. Some stop short at 280 days; others, like Dr. Reid, fix the maximum yet known at 293 days. Dr. Murphy allows from his experience at least 324 days: and Dr. Meigs considers that gestation may be continued to twelve months, or 365 days. (Obstetrics, the Science and the Art, 1849. p. 194.) The fact is, the term has not yet been fixed even approximately by medical science: hence, in a disputed case, other circumstances must be looked to in order to lead to a safe decision. It is at present hopeless to reconcile the conflicting medical opinions which exist on the subject of the duration of pregnancy in the human female. There is, indeed, only one point on which all modern observers agree, namely, that the period cannot be limited to a certain number of days, but that it is liable to variation according to numerous circumstances.

It has been already observed (*ante*, p. 610) that the date of intercourse does not furnish us with the date of conception, and according to some authorities all evidence connected with the function of menstruation is untrustworthy. In spite of these objections the menstrual period must generally serve as our guide in default of more certain criteria. It is, however, a curious fact, and one which the mind of an acute lawyer will not fail to appreciate, that the date of the cessation of the menses is taken by some physicians, as a guide (in married life with constant intercourse) so long as gestation does not extend beyond 280 days; while supposing it to extend to 300 days, they will assume that some other cause than pregnancy must have led to an earlier suppression, and thus to an error in the calculation! There may be no more evidence of suppression from a morbid cause in the one case than in the other, and the period of 280 days may be as much based in error as the period of 300. It is strange, that clever writers, who adopt this mode of making facts square with a foregone conclusion, do not perceive that they must, in fairness, either reject altogether the evidence derived from the cessation of the menses, or admit it adversely to their own views, in cases in which the facts connected with the cessation have been as carefully observed and recorded by others as by themselves.

Period of gestation not fixed by law.—In all cases of contested legitimacy, the question respecting the period of gestation, when it arises, is left entirely open by the law. No period has been fixed within which, or beyond which, a child, if born in wedlock, will be presumed illegitimate. The decision of a Court of law would be founded, quoad the duration of pregnancy, on the opinions of experienced practitioners selected for the occasion, and each case would be decided on its own merits. Precedents can have but little influence on these occasions, because a Court may think fit to pronounce illegitimate, on non-medical grounds, a child born in the thirty-eighth week of gestation: while it may decide that another was legitimate that had been born in the forty-third week. By some law authorities *forty* weeks are set down as the "*ultimum tempus pariendi:*"—but as the period of human gestation is wholly independent of any legal dictum, it is not the custom of Courts to act upon this as a rule. Nevertheless, it is clear in some cases the law must interpose, and pronounce for a reasonable limit. In the case of *Cotterall* v. *Cotterall*, decided in the Consistory Court, July 1847, the husband had proceeded against the wife for a divorce on the ground of adultery. The main proof was based on the fact, that in order to have been the child of the husband, it must have been born after *twelve months'* gestation. The husband had left his wife in New South Wales, and was absent for that period of time without possibility of access. Dr. Lushington, without entering into the question of protracted gestation, upon proof of this allegation, at once pronounced for the divorce. Such a duration of pregnancy is not supported by any known facts, and is altogether opposed to medical probability. In a recent affiliation case, before Mr. Selfe at the Thames Police Court (Oct. 1857), proof was afforded that the putative father had been absent from England eleven months and six days before the child was born, and on this evidence the case was at once dismissed. In March 1859, a case was referred for my opinion from Scotland, in which it appeared that husband and wife had parted on the 23rd Jan. 1858,—the husband having gone to the West Indies. A child was born on the 29th Dec. following, *i. e.* 339 days or 48 weeks and three days from the time at which the husband parted from the wife. The child died, and a claim was made on a Life Insurance Society for a sum of money alleged to be due to the parents on account of this child. The Society refused payment on the ground that the child was illegitimate. My opinion was adverse to the claim. The length of the alleged gestation and the state of the child when born, were sufficient to prove that it was not the child of the husband.

Evidence from the state of the child.—In protracted births it is not observed that the child is more developed, or of larger size, than at the usual period. In one of the supposed longest cases of protracted gestation on record (324 days) the child was not above the average size, although, when Dr. Murphy saw it, six months afterwards, it was unusually large and fat for a child of that age. (Obstetric Report, 1844.) This would lead to the inference that when a child has reached a certain stage of development it ceases to grow; a view which is borne out by the observations of Dr. Rüttel. (Henke, Zeitschrift, 1844, p. 247.) This gentleman has not remarked that the size of a child increases in proportion to the length of gestation. In protracted human and animal gestation, the offspring is not remarkable for size and weight. In both cases robust mothers have had small children, and small mothers strong and sometimes unusually large children.

The following case (*Luscombe* v. *Prettyjohn*, Exeter Summer Ass. 1840) will show how unsettled legal decisions are upon these points; and further that disputed questions of gestation may be decided without *medical evidence*, although there are few instances in which it is more urgently required. An action was brought against the defendant, by a farmer, to recover compensation for the loss of his daughter's services. It was alleged that the defendant had seduced her, and that she was delivered of a child of which he was the father. He denied that the child was his; among other reasons, on the ground that it was born two hundred and ninety-nine days, or forty-two weeks and five days after intercourse. No medical evidence was called to show that gestation might be thus far protracted; but the judge in summing up, is reported to have made the following observations:—"Upon the evidence it was almost *impossible* that he (the defendant) was the father. Supposing that she (the woman) were right, that would place the birth at nine calendar months three weeks and five days." [The last meeting between the parties was had on the 9th of February, and the child was born on the 5th of December, 1838, which is equal to an interval of 299 days.] After adverting to some medical authorities relative to gestation, he said:—"He would rather believe that she had yielded to some other attempt on her chastity, than that so wide a departure from the usual course of nature had taken place!" The jury did not concur in this view, and they returned a verdict for the plaintiff, thereby pronouncing an opinion, which is well borne out by medical experience, that the defendant might have been the father of the child, although *forty-two weeks and five days* had elapsed since the last access. (Lancet, Aug. 1840.) Had the verdict been the other way, there would have been fair ground, medically speaking, for a new trial; for the summing up was undoubtedly made on an entirely mistaken view of medical doctrines. It amounted to this, that the chastity of every married woman who bears a child in the forty-third week of pregnancy after the absence or death of her husband, is to be impeached,—and the legitimacy of her child is to be set aside on bare proof of this fact!

In a well-marked instance of gestation from a single intercourse, noticed by Dr. Reid, the interval was 293 days,—only six days earlier than the period here pronounced to be incompatible with legitimacy: and by referring to the cases of Drs. Rigby and Merriman, it will be seen that the periods of gestation from a single intercourse have varied to a much greater degree than the two here placed in comparison (p. 607). This shows the risk to which the decision of such questions is exposed, when medical evidence is not called for on matters so strictly professional. The following case, which was tried in the United

States, in January term, 1844, furnishes a contrast to that just quoted. (*The Commonwealth* v. *Porter*: Cambria county Pa.) The facts were somewhat similar. The defendant was indicted for fornication and bastardy. Prosecutrix, aged 23, stated that she had had intercourse with the defendant on the 24th September, 1842, and with no other person before or subsequently. She was delivered of a child on the 7th August 1843,—*i. e.* 317 days, or after *forty-five weeks and two days' gestation*; she swore that the defendant was the father of the child. The menses ceased about three weeks after intercourse, and they only appeared again slightly about five weeks before the child was born. At this time she had pains, which continued more or less until her delivery. She first knew that she was pregnant three or four weeks after intercourse. The defence was, that from the period of time which had elapsed, the defendant could not have been the father of the child. He, therefore, merely proved his absence, and that he did not return until after the birth of the child. No evidence was adduced to impeach the character or conduct of the female. It was proved that she had always borne a good reputation, and that she had been seduced by the defendant under promise of marriage. Dr. Rodrigue deposed, that, in a practice of nineteen years, he had attended some hundreds of cases of midwifery; and the longest period of gestation which he had known was *ten months*. He considered the pains described by prosecutrix to have been the commencing pains of labour. The Court charged the jury strongly in favour of the medical testimony on protracted gestation, and they returned a verdict of guilty, thereby finding that the defendant was the father of the child. It transpired that a wife of one of the jurymen had during one pregnancy gone ten months. (Amer. Jour. Med. Sciences, Oct. 1845, p. 338.) Dr. Rodrigue, who reports this trial, states that a case subsequently came to his knowledge, in which gestation continued for a period of 320 days.

It would appear that the question of protracted gestation is frequently raised in the United States under these circumstances. Another case of bastardy (*The Commonwealth* v. *Hooner*) was tried in May 1846, in which the alleged duration of pregnancy must have been 313 days, or forty-four weeks and five days. The prosecutrix deposed that she had had intercourse with the defendant on March 23rd, 1845, and not subsequently, —a fact established by the evidence; and the child, a large healthy male, was proved to have been born on the 30th January 1846. Twelve physicians were examined on the trial. and, as usual, they differed from each other. Some regarded it as possible, but not probable, that gestation might be so protracted as to reach 313 days. Various medical works were quoted on the subject. The Court charged the jury that, although unusual and improbable, this length of gestation was not impossible; and they returned a verdict finding that the defendant was the father of the child. (Dub. Med. Press, Nov. 4th, 1846, p. 296.) In the case of *Dyson* v. *Dyson* (Vice-Chancellor's Court, Feb. 18, 1852), it was proved that the husband left his wife in Madeira, in Feb. 1849, that she returned to England in the August following, and the child whose legitimacy was contested was born on the 8th Jan. 1850. It was contended that this was a case of protracted gestation, and the evidence of several medical men to the effect that gestation might be protracted for 330, or even 336 days, was quoted in support of this view. In this case there was a period of 336 days. The Vice-Chancellor, having referred to the Gardner Peerage case, declined to make a decree in favour of the legitimacy of the plaintiff. (Legal Examiner. Feb. 21, 1852, p. 93.)

In extra-uterine pregnancy, the fœtus may be carried for many years. Dr. Craddock relates a case, in which gestation was thus protracted for the very long period of twenty-two years. (Phil. Med. Exam. May 1846, p. 286.)

It will be seen by the foregoing cases and remarks, that in these suits of contested legitimacy the general practice consists in establishing possibility of access on the part of the husband:—when this is proved, the medical question arises, whether the term of gestation falls within those limits assigned by the best medical experience. In two instances, children have been pronounced legitimate, which were born, the one in forty-one weeks and three days, and the other in forty-one weeks and four days, after the death of the husband. Legitimacy has been allowed where gestation was probably protracted to the *forty-third week* (*Anderton* v. *Gibbs*, 1854); and in the United States, where it extended to *forty-five weeks* and two days (*Commonwealth* v. *Porter*, p. 633). It has been disallowed in the English Courts, although probably on non-medical grounds, where it was protracted to *forty-four weeks* and three days (*Gardner Peerage case*, 1825); in one case (judicially) because it had extended to *forty-two weeks* and five days (p. 632): and in another (*Dyson*, suprà), because it had extended to *forty-eight weeks*.

PATERNITY.

CHAPTER 55.

DISPUTED PATERNITY—EVIDENCE FROM LIKENESS—DOUGLAS PEERAGE CASE—PARENTAL LIKENESS—AFFILIATION—POSTHUMOUS CHILDREN.—SUPERFŒTATION IN RELATION TO LEGITIMACY—CIRCUMSTANCES UNDER WHICH IT IS SUPPOSED TO OCCUR—SUPERCONCEPTION.—SUPPOSITITIOUS CHILDREN—RELATION OF THE SUBJECT TO FEIGNED DELIVERY AND LEGITIMACY.

Disputed paternity. Parental likeness.—It has been stated that the law does not pretend to determine who begat a child when it has been born during wedlock, and from circumstances might be the child either of the husband or an adulterer. But medical jurists have recommended that family-likeness should be looked to on these occasions,—not merely a likeness in *feature* and figure, but in gesture and other personal peculiarities which may have characterized the alleged parent. These are called questions of *paternity:* they seldom occur except in reference to cases of bastardy, and when they do present themselves, the evidence thus procured, even if affirmative, is properly regarded as only corroborative. In the *Townshend Peerage* case (House of Lords, May 1843), a presumption based on family likeness was admitted by their lordships. The party whose legitimacy was in question was sworn by one of the witnesses to bear so strong a likeness as a child to the alleged adulterer, that he should have known him among five hundred children.

The proceedings in the *Douglas Peerage* case (1767-9) also show that evidence of this kind is occasionally of some importance. This peerage was claimed by Archibald Douglas—the survivor of two brothers after the death of the alleged parents, Sir John and Lady Douglas. The claim was disputed, on the ground that the appellant and his deceased brother were supposititious children. Evidence for and against the legitimacy of the claimant had been collected from every quarter, and after it had been most minutely sifted and criticised, the case came on for judgment in the Court of Session in Scotland on the 7th of July 1767. So important was the cause deemed, that the fifteen judges took eight days to deliver their opinions. The result was that seven of the judges voted in favour of the identity or legitimacy of Mr. Stewart, and seven against it; the Lord President, who had the casting vote, agreed with the latter, by which Douglas, *alias* Stewart, was cast on the world without either name or estate, thus furnishing one among numerous instances that judges as well as doctors can differ with precisely the same facts before them. An appeal from this decision was taken to the House of Lords, by which the judgment of the Court of Session was reversed in 1769, and Archibald Stewart, or Douglas, declared to be the undoubted son of Lady Jane, the sister of the late Duke. Much stress was laid, in favour of the legitimacy of the children, on the fact that they closely resembled—the one Sir John, and the other Lady Douglas. The resemblance was said to be general; it was evident in their features, gestures, and habits. Lord Mansfield, in delivering judgment, made the following remarks, which comprise all that can be said on this subject. "I have always considered likeness as an argument of a child being the son of a parent, and the rather as the distinction between individuals in the human species is more discernible than between other animals. A man may survey ten thousand people before he sees two faces exactly alike; and in an army of a hundred thousand men, every man may be known from another. If there should be a likeness of feature, there may be a difference in the voice, gesture, or other characters; whereas a family likeness runs generally through all of these: for in everything there is a resemblance, as of feature, voice, attitude, and action." This kind of evidence has been strongly objected to from its uncertainty; and I am informed, on good authority, that it was in this instance much disputed whether one of the children did resemble Lady Douglas. It seems to have been generally admitted that the other child resembled Sir John Douglas. From this account, it will be seen that evidence from family-likeness, is not strictly medico-legal,—it can be furnished only by friends and relatives who have known the parties well, and are competent to speak of the facts from personal acquaintance with them. It will also be apparent that the affirmative evidence in such cases will be stronger than that which is negative: for it could hardly be inferred that a person was illegitimate, because he did not resemble his parent.

Parental likeness may be occasionally indicated by colour or peculiarities belonging to the varieties of mankind, as of the intermixture of the Negro with one of the Caucasian variety. In such a case the evidence afforded becomes much stronger; and supposing that two men of different varieties have intercourse about the same time with the same female, the colour of the skin may enable a Court to determine the question of paternity. It is stated to have happened on more than one occasion, that a black woman has given birth at the same time to a black child and a mulatto: and Dr. Cunningham refers to a case in which a negress gave birth to twins, one a black and the other a white child. (Lancet, May 9, 1846, p. 525.) This was probably a case of superconception. In *Stothard* v. *Aldridge* (Bail Court, January 1856), the plaintiff sued the defendant for damages for the seduction of his wife. The defendant was a man of colour, and the child born of the alleged adulterous intercourse was proved by the medical witness to have been born coloured and with woolly hair. The husband and wife were both light. This peculiarity fixed the paternity of the child on the black defendant.

Personal *deformities* are not necessarily transmitted from parent to child; yet it would appear from the subjoined case, that a disputed question of affiliation has been settled on this principle. A woman alleged that a gentleman in whose service she had lived, was the father of a child of which she had been recently delivered. The solicitor, who appeared to support the affiliation, rested his case chiefly on the fact that the child had been born with five fingers and a thumb on the right hand, the defendant himself having been born with a similar malformation on both of his hands. It was argued on the other side, that the deformity might have arisen from the mother's imagination, as, while pregnant, she was constantly in the habit of seeing the defendant. The magistrates decided that he was the father of the child, and condemned him to pay the necessary expenses for its support. (Med. Times, March 6, 1847, p. 47.) It is very likely that the decision was here influenced by moral circumstances; for otherwise the defendant might have been the victim of a coincidence. Six-fingered children are, it is well-known, born occasionally of five-fingered parents: and as the deformity existed only on one hand in the child, while it was on both hands in the parent, the medical proof that it was actually transmitted by generation was certainly not clearly made out. In some instances attempts have been made to fix the paternity of a child by the *colour of the hair*, but this evidence is far less conclusive than that afforded by the colour of the skin. In the case of *Frazer* v. *Bagley* (Feb. 1844), the wife of the plaintiff was alleged to have had criminal intercourse with the defendant, and the last two children were alleged to be the offspring of the latter. The plaintiff and his wife had dark hair, as well as all the children with the exception of the two last: — these had red hair; and it was further proved that the defendant had red whiskers and sandy hair. No particular stress was laid upon this evidence, but it was received as a kind of indirect proof. But little confidence can be placed on facts of this description, since red-haired children are often born to parents who have dark hair; and in one case the children born in wedlock were observed to have dark and red hair alternately.

Affiliation.— Questions of paternity are involved in those relating to *affiliation*. A party may allege that he is not the father of a particular child, by reason of certain circumstances upon which a medical opinion may be required. The necessary transmission of gonorrhœa or syphilis by intercourse, may thus become a medical question. In September 1844, a man was required, under the law of bastardy, to support two children alleged by a female to be his. The time of gestation was within nine months. The accused denied that he had had intercourse with the deceased, or that he could have been the father, since he was at the time under medical treatment for the venereal disease. The medical questions may therefore assume this shape: — 1. Are these diseases invariably transmitted by intercourse? 2. Do they interfere with the act of procreation? Under common circumstances they must both be answered in the negative.

A singular case of bastardy is reported to have occurred in Appenzell, Switzerland. The question was, which of two persons, who had had intercourse with the same woman within a period of *seventeen* days, was the father of an illegitimate child borne by the woman. The Council to which the case was referred gravely resolved to postpone their decision until the features of the child were so far developed as to enable them to decide from *paternal likeness.* The equity of this difficult case would have been met by compelling each man to contribute to the support of the child! (Schneider's Annalen der Staatsarzneikunde, 1836, 1 B. s. 470.) The following, which is a more doubtful case, was the subject of a communication to the Lancet (March 13, 1847, 336). Two men, A and B, had intercourse, unknown to each other, with a young woman of delicate health; and after this had continued for some years, she was delivered of a female child nine calendar months and three days after sexual intercourse with A, and nine calendar months, less five days after similar intercourse with B: or at the end of 279 days after intercourse with A, and at the end of 271 days after intercourse with B: that is, a period of *eight days* elapsed between the periods of intercourse of the two men. The woman had no menstrual discharge in the meantime, and it is not believed that she knew any other man. She went her full time, had a good labour, and produced a fine healthy girl: had a plentiful supply of milk, and enjoyed better health during her pregnancy and suckling than at any other time. The woman died, and the circumstances of the mixed intercourse having become known to A and B, they both refused to maintain the child. A contended that, as the woman was not delivered until nine months and three days after the connection with him, it was physically impossible the child could be his. B contended, on the other hand, that 280 days, and not nine months, is the period of gestation: and that the child having been born 279 days after connection with A, and only 271 days after connection with B, it was therefore probable that the child was begotten by A. There was no perceptible likeness to either of the men in the child, but a marked likeness to the mother. It is obvious, from the remarks elsewhere made (*ante*, p. 607), that the periods, 271 and 279 days, are comprised within the common range of gestation: hence there would be no *medical* ground for affiliating the child to one more than the other. When two men have intercourse with the same female on the same day it is impossible to settle the paternity except by the accident of likeness. As in the former case, justice to the offspring and to each possible father required that they should have been both bound to support the child. In cases of affiliation under the law of bastardy the evidence of the mother, if corroborated, is received in support of a question of disputed paternity. Sometimes these cases are decided by the length of the period of gestation. A man may prove, or a woman may state, that the intercourse took place at such a remote period as to be inconsistent with the ordinary duration of pregnancy. On this point some remarks have been made elsewhere (*ante*, p. 632). In the United States it appears that long dates are allowed in bastardy cases (*ante*, p. 633). In this country the tendency is to reject the evidence. In a case at Cheltenham (July 1853) the date of intercourse was proved to have been three hundred and nineteen days before the birth of the child. The medical evidence on the whole was in favour of this protraction — one of the witnesses having met with two cases in which gestation was protracted to three hundred and ten days from intercourse. The case was dismissed.

These questions of affiliation, when the interval is less than six or eight weeks, can rarely be determined by medical evidence. In a twin case, it would be only just that one child should be affiliated to each individual. In a recent case of affiliation, an attempt was made to set aside the order of a magistrate fixing the paternity on the putative father, on the ground that, as the intercourse was had, and the child conceived, in France, although born in England, it was removed from the jurisdiction of an English magistrate, and should be left to the French Courts. The objection was properly overruled, and the alleged father was ordered to pay the usual sum for maintenance. The place of birth should properly fix the liability, as any other rule would be too vague. From that which has been elsewhere stated (*ante*, p. 605) the reader will perceive that in a given case intercourse might take place in Scotland followed by conception in England and birth in Ireland. So that there is a due relation between the date of intercourse and the date of birth no other proof is required.

Posthumous children.— It has been supposed, that a case involving a question of paternity might present itself on the marriage of a widow soon after the death of her first husband. If a child were born after the lapse of ten months, it might be a question whether it was a child of the first or second marriage—of the dead or the living husband; and although there might be no dispute concerning its legitimacy, yet it would be difficult to settle its *paternity*. Such a case appears hypothetical. In order that any doubt should exist, a woman must marry within, at the furthest, *six weeks* after the death of her first husband, or the birth of the child would fall beyond the furthest limit of gestation, so far as he was concerned. The customs of society are, however, a bar to such marriages; and admitting that a child was so born, and that it might be the offspring of either husband, then the fact of its having been born during the marriage of the second husband would presumptively fix the offspring upon him, unless it could be shown that there was no possibility of access on his part. If there were a supposed greater likeness to the first than the second husband, still this would not be allowed to defeat the legal presumption of the real parentage of the child. It appears to me, that evidence much stronger than this would be required for such a purpose. (See Henke, Zeitschrift, 1838, vol. 2. p. 432.)

SUPERFŒTATION.

Superfœtation in relation to legitimacy.—Most medico-legal writers, in treating legitimacy, have considered it necessary to introduce the subject of superfœtation. By this we are to understand, that a second conception may at any time follow the first, and that gestation may go on to its full period in each case independently of the other,—so that if a woman were impregnated when in the third month of gestation, she would bear the first child mature at the end of nine months, and the second child, also mature, at the end of twelve months, after the first conception. This subject has been said to involve "not only the conjugal fidelity of a wife, but the disposition of property, and much of the comfort and happiness of society." Its importance to a medical jurist appears to me to have been here considerably exaggerated. So far as I have been able to ascertain, not only is there no legal case involving this question, to be met with in the judicial records of this country, but none, in reference to this state is ever likely to occur which would create the least practical difficulty. If we admit that a woman may, during marriage, present such an extraordinary deviation from the common course of nature, as to produce two perfectly mature and fully developed children, the one three or four months after the other, how can such an event be any imputation on her fidelity? Superfœtation, if it occur at all, may occur as well in married life, during connubial intercourse, as among unmarried females. The following appears to be the only possible case wherein a medical opinion might be required respecting this alleged phenomenon. A married woman, six months after the absence or death of her first husband, gives birth to an apparently mature child, that dies. Three months afterwards, and nine months after the absence or death of her husband, she may allege that she has given birth to another child also mature; a medical question may arise, whether two mature children could be so born, that the birth of one should follow three months after the birth of the other,—or whether this might not be a case, by no means uncommon, of twin children, the one being born prematurely, and the other at the full period. (For a case of this kind, at two months' interval, see Med. Gaz. vol. 37. p. 27; and for another at eight days' interval, see the same journal, vol. 47. p. 227; for a third, at thirty-two days' interval, Am. Jour. Med. Sci. April 1845, p. 503.) Mr. Brown has more recently published a case in which abortion of one fœtus occurred at the third month, while the other attained the full period. (Assoc. Medical Journal, Nov. 11, 1853, p. 997.)

Admitting that both the children were mature, and therefore that it was a case of superfœtation, the first delivery must have taken place in the presence of witnesses, and it would then have been known whether another child remained in the uterus or not. If the two children were born within the common period of gestation after the absence or death of the husband, then their legitimacy would be presumed, until the fact of non-access was clearly established. The mere circumstance of their being apparently mature, and born at different periods, would *per se* furnish no evidence of their illegitimacy. On the other hand, if one or both of them were born out of the ordinary period, then, according to the evidence given, they might or might not be pronounced illegitimate. The law therefore appears to have no sort of cognizance of the subject of superfœtation as such: it is entirely merged in the question of protracted gestation, which has already been fully considered (*ante*, p. 625).

Super-conception.—Whether superfœtation can really take place or not, is a question which has given rise to much controversy. That one conception may follow another within a short period, and that twins may thus be the result of two distinct conceptions, is a probable occurrence. This, indeed, is what may be termed *Super-conception.* But when gestation has already gone to the second month, it has been hitherto considered highly improbable that there should be a second conception. In two cases, however, in which two men had intercourse with females within the period of seventeen and eight days respectively—cases favourable to super-conception,—there was, in each case, only one child, and the paternity was actually disputed. (See *ante*, p. 538.) According to Donné, there is a limit to this power of super-conception. He has found that the mucus secreted from the vagina of pregnant females, is, by reason of its great acidity, completely destructive of the existence of the zoosperms, and therefore renders the spermatic fluid unprolific. (See post, STERILITY.) It does not appear, however, that the vaginal mucus becomes more acid in the pregnant state; but, according to Mr. Whitehead, the effect is due to this acid secretion not being partially neutralised, as in the unimpregnated state, by the alkaline mucous secretion of the uterus. (On Abortion, p. 406.) At what period of pregnancy the vaginal mucus begins to act destructively on the zoosperms, has not yet been determined; but further researches may show that we have in this chemico-physiological theory a complete answer to the old doctrine of superfœtation.

In a paper published in the Association Journal, May 6, 1853, p. 398, Dr. Duncan, in referring to the occurrence of menstruation during the early months of pregnancy, considers that he has obtained anatomical proofs that this discharge may take place from the inner surface of the uterus after impregnation, and up to the third month of gestation. He believes that during this period super-conception may occur, and that this will satisfactorily account for all the cases of superfœtation which are on record. We may suppose that the first child is born prematurely, but within the limits of viability: we thus gain two months: and if impregnation may take place between two and three monhts after one conception, we may thus have four or five months' interval between the births of successive viable infants. It is not therefore necessary to suppose that they have both been conceived at the same time. Until the mouth of the uterus is closed as a result of the development of an embryo, it is possible that conception may take place from intercourse subsequently to a previous conception. The exact period at which this closure occurs has not been determined; but according to Dr. Duncan the menstrual secretion may find its way through the mouth of the uterus for at least *two months* after conception. If this be the case, a second conception might occur two months after a first conception; but I am not aware of any facts to support this statement. It cannot be denied that super-conception may occur in cases in which two separate intercourses have been had within a few days of each other; and according to some, twins may be generally regarded as the result of this double conception at different periods. (Ramsbotham's Obstet. Med. 500.)

Dr. Carter has reported the following case in the Philadelphia Medical Examiner. A negro woman, quite black, æt. 23, and of good constitution, had borne three children previously to her last labour. She stated that in April 1848 she had had connection with a white man, and on the following day with a black man. This was about a week or ten days before the cessation of the menses. In the middle of February 1849 she was delivered of twins, one of the children (the first-born) being as dark as negro children generally are, while the other was a mulatto. The woman believed that they were begotten by different fathers; and this is rendered highly probable by the difference in the colour of the skin. (Ed. Month. Jour. May 1850, p. 485. See *ante*, p. 536.) The reader will find several cases of a similar kind reported by Dr. Ramsbotham. (Op. cit. 501.)

Most cases of alleged superfœtation appear readily explicable on the supposition that the woman was pregnant with twins, and that one was born prematurely, and the other at the full time, or later. The following, reported by Dr. Möbus, of Dieburg, (Henke's Zeitschrift der S. A 1837,) will serve as an illustration; —A healthy *married* woman, about thirty-five years of age, was safely delivered of a girl on the 16th of October, 1833. This child is described as having been well formed, and having borne about it all the signs of maturity. This woman, it is to be observed, had previously had several children in a regular manner. Soon after her delivery and the expulsion of the placenta, she felt, on this occasion, something still moving within her. On examination, the mouth of the uterus was found completely contracted, and the organ itself so drawn up as to render it difficult to be reached: but the motions of a second child were still plainly distinguishable through the parietes of the distended abdomen. Her delivery was not followed by the appearance of the discharges (lochia), or by the secretion of milk. The breasts remained flaccid, and there was no fever. On the 18th of November, *thirty-three* days after her first confinement, this woman, while alone and unassisted, was suddenly delivered of another girl, which, according to Dr. Möbus, was healthy, and bore no signs of *over-maturity* about it. The reporter alleges that this case most unequivocally establishes the doctrine of superfœtation. The two births took place at an interval of *thirty-three* days, and the two children were, it is stated, when born, equally well-formed and mature: but Dr. Möbus did not see the second child until twenty-four hours after birth.

This appears to have been nothing more than a twin case, in which one child was born before the other. Dr. Möbus considers, that the first child was born at the usual period of gestation, it being described as mature; and the other, thirty-three days after that period,—having been, in his view, conceived so many days later than the first child. If, however, we imagine that in this, as it often happens in twin cases, one twin was more developed than the other, and that the more developed was the first expelled; or that it is not always easy to compare the degree of development in two children, when one is born before the other and they are not seen together, we shall have an explanation of the facts, without resorting to the hypothesis of a second conception after so long an interval. As to the signs of *over-maturity* alluded to, they are not met with. If we are to believe authentic reports, a child born at the thirty-ninth week cannot be distinguished from one born at the forty-third or forty-fourth (*ante*, p. 531), and children born at the full period vary much in size and weight. A longer time may be required to bring children to maturity in some women than in others; and in a woman with twins, it is well known that two children may arrive at the same degree of maturity within different periods,—one requiring, perhaps, several weeks longer than the other for its full development.

Cases of abortion of one twin, the other remaining in utero, are by no means uncommon. In addition to those already quoted, two are referred to in the Ed. Med. and Surg. Journal (1839, p. 289). In one, abortion took place at three months, while the woman went to her full time and was delivered of a healthy child at nine months. In the second, one fœtus was expelled at about four and a half months, while four months afterwards a full-grown child was born. In a third case, reported by Dr. Nevins, a woman was delivered of a premature fœtus, and six weeks afterwards was confined of a full-grown child. (Med. Gaz. vol. 46, p. 983.) Even under a malformation which might be supposed to be favourable to its occurrence, namely, the presence of a bilocular uterus, it has been found that impregnation has taken place in one cornu only. (See Med. Gaz. vol. 19, p. 507.) A singular instance is, however, recorded in the same journal (vol. 20, p. 508), where a woman, six months after marriage, bore a four months' child, and forty weeks after marriage, mature twins. On examination, the uterus and vagina were both found double, and each vagina had a separate orifice. Dr. Horlbeck, U.S., states that he met with a case in which a well-grown fœtus of six months was simultaneously expelled with an embryo about six weeks old! (Med. Gaz. vol. 44, p. 87.) In the Medical Times (Jan. 31, 1852, p. 104) Dr. Foley has published the account of a case in which a mole was expelled from the uterus at an early period of pregnancy, while the female was delivered, about the usual period, of a living and well-formed although weakly child, which survived its birth three days.

Monstrosity and Superfœtation.—An extraordinary case of monstrosity, involving the questions of superfœtation and paternity, is stated to have occurred at Alexandria in Egypt. A Fellah woman was delivered of a dicephalous monster at apparently about the eighth month of uterine life, of which one head was *white*, and the other head was *black*, possessing in other respects the negro conformation, and this head was fully developed. The monster was born dead, and the mother died soon after her delivery. The change in the colour of the skin commenced at the neck of the black head, and was found by M. Prus, a physician at the port of Alexandria, to be due to the existence of a colouring matter similar to that found in the skin of the Negro race. The husband of the woman was a Fellah, whose skin was of a brownish colour. There were Negro labourers in the port, but it could not be ascertained whether the woman had had intercourse with any of them. It is therefore impossible to say whether this was or was not a case of impregnation about the same time by two men of different races. Admitting that this occurred, it is difficult to understand why the black colour should have been confined to the head only. (See L'Union Médicale, 5 Août, 1848.)

SUPPOSITITIOUS CHILDREN.

Another medico-legal case in relation to legitimacy, occurs when a woman feigns delivery, and represents the child of another person to be her offspring. She may substitute the living child of another woman for a dead child of which she herself has been delivered, or for a mole or hydatids which may have passed from her. So, again, a male may be substituted for a female child, and *vice versâ*. The practising of a fraud of this nature may seriously affect the rights of inheritance of parties; but it cannot be accomplished without great dexterity and cunning, or without the co-operation of several accomplices. Frauds of this kind have, in general, been committed by the aid of a low class of midwives. One instance occurred at Chelsea, in July 1842, where the fraud was brought to light by the death of the supposititious child. The calling in of a professional man would infallibly lead to discovery, when the question was simply whether delivery had or had not taken place; but if it be alleged that one living child has been substituted for another, the proof of this can depend on medical evidence, only when the age of the supposititious child does not happen to correspond to the pretended delivery. (See Ann. d'Hyg. 1829, t. ii. p. 227.) The legitimacy of the claimant of the Douglas peerage was disputed on this ground, but apparently without foundation (ante, p. 535). A remarkable case of this description will be found in Henke's Zeitschrift der S. A. 1845, t. ii. p. 172; and a trial has taken place in England, involving the alleged substitution of a child, but requiring no medical evidence for its elucidation. (*Day* v. *Day*, Leicester Lent Ass. 1845.) In another case, elsewhere noticed (*ante*, p. 564), it was proved that a woman had substituted a doll for the dead body of a child of which she pretended she had been delivered. In a case mentioned by Dr.

Chevers, one Mussamat Jauvo, a midwife of Hissar, being employed to attend a woman in her confinement, persuaded the unfortunate creature that the child of which she had been delivered was a monster with two heads, not fit to be looked at: she afterwards said that it was dead and she would take it away and bury it. She accordingly went away. Next morning the midwife's services being required, she was sent for. She excused herself from going under the pretence that she herself had just been delivered of a child. This improbable story excited suspicion and the police were called in: she declared that the child was her own. This she also maintained at the trial. It appeared, however, from the evidence of midwives who examined her shortly after the discovery of the child in her house, and also by the deposition of the civil surgeon, that she exhibited no signs of recent confinement. Several of the neighbours who were constantly in the habit of seeing her, deposed that she had not exhibited any outward signs of pregnancy. She did not attempt to prove how she had disposed of the body of Jauvo's child which she alleged had died immediately after its birth. She was convicted and sentenced to imprisonment for seven years. (Med. Jur. for India, 513, from the Nizamut Adawlut Reports, 26th April 1853.)

The manner in which an imposition of this kind may be carried out, is well shown by a case which occurred in France. The female was in this instance a deaf and dumb woman, married; and it appeared that the husband was in collusion with her. It was not in her power to make any disposition of some property to which the children of her marriage would be entitled, and by the advice of her husband she simulated pregnancy in order to deprive the heir-at-law of the property to which he would be entitled at her death. The facts, as far as they could be ascertained, were as follows:—The woman was forty-two years of age, and although married for a period of twenty years, had borne no children. On this occasion, admitting her statement to be true, she was delivered without any medical assistance. All her acquaintances and friends were ready to depose that for six months she had presented the usual progressive appearances of real pregnancy, and that she had manifested the usual indisposition attending this state, including occasional faintings at the parish church, &c. For the heir-at-law it was contended that she had substituted, in her false accouchement, the child of a person named *Peyrins*, born only a few days before; and that she had made a false declaration of the birth. A midwife was ready to depose that the deaf and dumb woman had never been a mother. The decision in this singular case is not stated. (Ann. d'Hyg. 1847, vol. 1. p. 463.) It is obvious that it can only be by the coincidence of simultaneous delivery of another female in secrecy (whose pregnancy is unsuspected), that a trick of this kind can be successfully practised.

A case involving a question of substitution (*Hutchins* v. *Hutchins*) was heard in the Vice-Chancellor's Court in May 1851. The amount of ingenuity required to perpetrate a fraud of this kind was only equalled by the skill with which the facts were exposed, and justice was ultimately done to a rightful claimant.

HERMAPHRODITISM.

CHAPTER 56.

SEXUAL MALFORMATION — HERMAPHRODITISM — ANDROGYNUS — ANDROGYNA — DISTINCTION OF SEX — MISTAKES IN THE SEX OF CHILDREN — CAUSES OF SEXUAL DEFORMITY IN THE FŒTUS — LEGAL RELATIONS — CASES IN WHICH THE DETERMINATION OF SEX IS NECESSARY. — IMPUTATION OF HERMAPHRODITISM — REMOVAL OF SEXUAL PECULIARITIES BY OPERATION — THE RIGHTS OF ELECTORS DEPENDENT ON A NORMAL CONDITION OF THE SEXUAL ORGANS. — CONCEALED SEX.

General remarks.—The legitimacy of a child is open to be contested under other circumstances than those connected with the duration of gestation. The alleged parent may have laboured under *physical incapacity* ; if a male, he may have been affected with impotency ; if a female, she may have laboured under sterility ; and if either of these conditions be proved, the illegitimacy of a child will be established, although the alleged period of gestation may be comprised within the ordinary limits. The sexual conditions now about to be considered have also important bearings in relation to divorce, and occasionally to the civil rights of a child that may be the subject of the malformation. One of the most common and obvious causes of impotency or sterility is malformation of the sexual organs, to which species of monstrosity the term *hermaphroditism* is commonly applied.

SEXUAL MALFORMATION.

Owing to arrested development, during the growth of the fœtus, the sexual organs, which can scarcely be distinguished at the fourth month, occasionally assume an abnormal arrangement. These organs appear to be at that time more or less mixed ;

and sometimes the male, and at others the female characters predominate. With this defective sexual development, the other peculiarities of the sexes are either wanting, or we find them more or less blended. When, therefore, the being has the characters of a male with malformation of the generative organs it is called *androgynus* — when the characters are those of a female with a like malformation, *androgyna*. There can be no difficulty in identifying such cases, and, according, to the degree of malformation, a medical jurist can have no hesitation in pronouncing these persons to be incurably impotent. The organs are commonly so defective as to be wholly unfitted for the functions of either sex. It is not intended to be said that it is in all cases easy to assign the sex, but this is of minor importance; — the main question is, whether the malformation is or is not such as to justify divorce, or the imputation of illegitimacy upon children claiming to be the offspring of these beings.

Distinction of sex.—The determination of *sex* in these cases of *deformity* has been considered to be necessary under certain circumstances: as when, for instance, a title or entailed inheritance of lands is in question. Lord Coke has stated that, according to the law of England, an hermaphrodite may be either male or female, and it shall succeed according to the kind of sex which doth prevail. Thus it is obvious, that the law will decide each case according to the special circumstances attending it: but it must not be supposed that the decision is so easy as Lord Coke's doctrine would imply. There are many cases in which neither sex can be said to prevail. The beings are positively neuter. The chief character of the male would consist in the presence of testicles, and of the female in the presence of a uterus and ovaries. But in a case which occurred to Mr. Grigor, both the testicles and the ovaries were wanting: there were no essential characters of either sex, and during life it would have been impossible to say whether this being was male or female. (Cormack's Monthly Journal, July 1845, p. 492.) In the same journal (page 531) is reported another case, in which notwithstanding the *external* resemblance to a female, the presence of one testicle in a scrotum showed that this individual was of the male sex. Yet this person passed for a woman until he had reached his 26th year! It is rare that there is external malformation without internal defect, and even when the female character preponderates in the person, it is not improbable that the uterus or the ovaries may be absent, or the former may be malformed. Such beings are not known to menstruate, and even if there be capacity for intercourse, they are permanently sterile. Sexual desires are, however, commonly absent.

When the person is young, mistakes respecting the sex are more common than at an advanced period of life. So soon as the age of puberty is past, certain changes take place in the configuration of the body, which may aid a medical practitioner in forming an opinion. Thus, a grave tone of voice, the presence of a beard, the width of the shoulders, and narrowness of the pelvis will indicate, cæteris paribus, the male sex: while when these conditions are absent, and there is a rotundity of the members, with want of prominence in the muscles, and a development of the mammæ, we may pronounce upon the female sex predominating. Although no testicles are apparent, still the being may be of the male sex, since it is well known that in persons otherwise well formed these organs occasionally do not descend to occupy the scrotum. Dr. Harris, of Clarkesville, has related a singular case, in which, although no testicles could be found, there was a short, but naturally formed penis, through which the being regularly menstruated! The female character predominated in the corporeal development, and there was the rudiment of a vagina. (Med. Gaz. vol. 40. p. 562.) The fact that the being menstruated was here sufficient to assign it to the female sex. How easily mistakes may be made in the sex of young children is shown by a case which occurred to Mr. Terry, and is quoted in Cormack's Journal (April 1845, p. 307). The child was christened as a female, and was so considered by the parents for two months, when, owing to some defect in the passage of the urine, it was brought to Mr. Terry, and he found there was a malformation of the penis,—no vagina, a scrotum with one testicle down and the other descending. He therefore pronounced it to be a male, and its costume was altered accordingly. The presence of a beard and whiskers is usually considered to characterize a male, but the growth of hair on the chin and face is sometimes more profuse in females than in the generality of males. Dr. Chowne examined a female named Joseph Boisdechine on behalf of a man who was about to marry her, but who required a certificate as to the real sex of his intended wife! Dr. Chowne found nothing in her external conformation indicative of doubtful sex. The breasts were large and full, and the only resemblance to a male was in the abundance of beard and profuse whiskers. The upper lip was free from hair. (See Lancet, Oct. 11, 1851, p. 335; January 15, 1853, p. 66; Med. Times and Gaz. January 15, 1853, p. 71. Dr. Chowne has published a full account of this case in the Lancet for May 1, 1852, p. 421.) He has appended an engraving which displays the female beard and whiskers. It is stated that this female was born with a quantity of hair on her chin, and that at eight years of age the beard was two inches long!

In some cases an external examination will entirely fail in indicating the sex, and even the opportunity of an examination of the dead body may leave the case in doubt. An ingenious writer has laid it down that there are analogous organs in the two sexes which are never found in the same subject, and the separate existence of which would enable us to determine the sex. These analogous parts are the penis and the clitoris — the scrotum and the labia — the testicles and the ovaries — the prostate gland and the uterus. This, however, is an artificial and, as facts show, an incorrect means of distinction. (See report of a case, in which a body resembling the prostate gland and a uterus existed in the same being, Med Times and Gaz. February 18, 1860, p. 177.) If a penis could always be clearly distinguished from a clitoris, and a scrotum from the labia, the rule might be serviceable: but it fails where it is most required, *i. e.* in the mixed conditions. As to the other means of distinction, even if correct, they will only enable an examiner to form an opinion of sex in the dead, whereas it is during the *life* of one of these beings that the law requires the aid of medical science in the solution of these questions. The reader will find, in the Medical Times and Gazette, an account of some remarkable cases of sexual malformation by Mr. Curling (Jan. 24, 1852, p. 84); by Mr. Fletcher (Feb. 7, 1852, p. 136); by Mr. Broadhurst (Feb. 21, 1852, p. 187, and by Mr. Waters, May 21, 1853, p. 538). Other cases, reported by Mr. Mann and Mr. Churchill, will be found in the Association Journal, 1853 (Aug. 19, p. 720, and Sept. 9, p. 799).

Mixed cases.—A case has been already mentioned in which neither testicles nor ovaries were found after death, and more than one instance has occurred in which both have been found, —a case of intermixture of the sexes or real hermaphroditism, physically speaking, but of course without the functional power of self-impregnation. The following case is mentioned by Briand:—The subject was about eighteen years of age when he died. The body was partly that of a male in configuration, and partly that of a female. An examination of the sexual organs, externally, led to no satisfactory distinction: and on inspection after death a testicle was found in what was supposed to be the left labium, with an epididymis and a spermatic cord attached to it as usual; while on the other side were an ovary, Fallopian tube, and the rudiments of a uterus. The authenticity of this case was for some time a matter of dispute; but another, equally singular in its features, occurred to Prof. Mayer, of Bonn. This case clearly shows that such extraordinary deviations may be met with in nature. The person examined by Mayer died in 1835, at the age of 55. Different opinions had been formed during the lifetime of the being respecting the sex, by the first anatomists in Europe: some affirming that it was a male, while others contended that it was a female. This difference of opinion is sufficient to prove that an *external* examination does not always enable even a good anatomist to pronounce an opinion on the probable sex of the being. In the dead body was found, on the right side, a withered testicle, with a penis and prostate gland, as male peculiarities: — while on the left side was an ovary, with a uterus, vagina, and Fallopian tube. (Med. Gaz. vol. 19. p. 135.) It should be stated that the general configuration of the body in this case was that of a female; but there was a duality of sex. The right half of the body was male, and the left half female.

Causes.—The causes of malformation of the sexual organs, as of all other kinds of monstrosity, are involved in mystery. We know that in the early part of utero-gestation, the sex of a fœtus cannot be distinguished; while, even when it has reached the fourth month, the genital organs are so similar that the sex can seldom be determined on inspection. Some organs or parts appear to be formed by equal and symmetrical portions, which gradually approximate and unite in the median line of the body. We observe this mode of union in the bones of the head, chest, and spine, as also in the various fissures (raphes) of the skin, which are the remains of a union between two equal and symmetrical parts of an organ, now become one. In regard to defects in organization, it may be remarked that they almost invariably occur in or about some part of the median line; and they appear to proceed from a mere arrest of growth or development in those particular parts, either on one side or both, during the early stage of uterine existence. In this respect, the fissures sometimes observed in the palatine bones, in the palate itself, or in the lip — the openings occasionally noticed in the chest, diaphragm, anterior parietes of the bladder, as well as in the spinal canal, are precisely analogous in origin to the defective development of the sexual organs. There is nothing absolutely removed or lost, but there is an arrest of development; an opening, or fissure, which nature intended to be only temporary, becomes permanent by reason of an arrest or growth. In the evolution of the male genital organs, the part corresponding to the scrotum is at first always divided by a considerable fissure: and the penis and the clitoris having, at this period of life, much the same kind of physical exterior, the sexual organs cannot be well defined. Should this fissure in the male not be afterwards filled up, then we shall have the most common variety of sexual malformation,— the hermaphroditic form, with the male predominating. These observations are not, of course, applicable to those cases in which the sexes are positively mixed. In these instances there appears to be a separate sexual organization on the two sides of the body, with an imperfect development of each set of sexual organs. According to Weber, there is in the prostate gland a rudimentary uterus in every male. (Baly and Kirke's Recent Advances in Physiology, 1848, p. 112. Also papers by Dr. Knox, Med. Gaz. Nov. and Dec. 1843.)

One circumstance is worthy of note, namely, that sexual monstrosity appears occasionally to occur in the successive pregnancies of a well-formed female. The late Dr. Lever met with a singular instance of this in a female aged 28. She had given birth to four children in three confinements, the first being a twin labour; both the children males: and in both there was an arrest of development of the sexual organs. On the third delivery the child was a male, and its sexual organs presented the same deformity as those of the twins. (Med. Gaz. vol. 38. p. 946.)

Legal relations.—These beings, owing to defective development, are impotent and sterile. Questions connected with the legitimacy of offspring, divorce and affiliation may, therefore, be raised with respect to them. This part of the subject will be considered hereafter (p. 666). Sexual monstrosity is not a ground for depriving a being of the rights of inheritance except under peculiar legal conditions. Thus, a right of succession or inheritance to landed estate may depend upon the *sex* of the offspring,—as where, for instance, two children are born, the first an hermaphrodite, the second a well-formed male child. The parents die, and a title of nobility or lands may fall to the first-born male. Here the sex of the first-born must be determined before possession can be had. In a case of this kind, if medical evidence should establish that male peculiarities predominate in the first-born the second child would be cut off. Again, if an estate were limited by entailment, as where it is settled upon heirs male or female of a particular family, the birth of an hermaphrodite, an only child, would create the legal necessity for a positive determination of the predominance of sex. So, if the hermaphrodite live but a few minutes after birth, and then die, the rights of persons may be subsequently much affected by the medical attendant having come to an opinion respecting its sex. Since we cannot determine under what circumstances litigation may ensue, it is always right in a doubtful case to observe the sex, and make notes on the spot when a child thus malformed survives its birth but for a short period. The question of tenancy by courtesy, or the right of the husband to landed estate of which the wife was seised, will depend entirely upon the attention of the accoucheur to this point. (See *Tenancy by Courtesy, ante*, page 591.)

When these beings have reached adult age, other questions may arise with respect to them. According to an old law of France, an hermaphrodite was permitted to choose one sex, and thereafter compelled to keep it! Hermaphrodites, or sexual monsters, were formerly ranked with infamous persons: and it has been a grave question in our Courts, whether the calling a man an hermaphrodite was not such a libel or slander upon him as to render it a ground for a civil action. In a case reported by Chitty (Med. Jur. 374), the use of this term was held not to be actionable, unless it was proved that it had been attended with special damage. A dancing master brought an action against a party for calling him an hermaphrodite, and it was decided that it was not sustainable: — 1. Because such a union of the sexes cannot exist in fact, and every one must be supposed to know it; consequently the assertion could not be supposed to prejudice. 2. Because, admitting the possibility of such a double function, the party would be just as good, and perhaps even a safer dancing master, than if only one perfect sex had been discoverable,—consequently the words would not, in legal presumption, injure him in his profession or occupation!

I am indebted to a learned member of the bar for a note on the remarkable case of the *Chevalier d'Eon.* There was a great dispute concerning the sex of the Chevalier, and it came before a Court of Law on an action to recover a wager under the following circumstances (*Da Costa* v. *Jones*, 2nd vol. Cowper's Reports, p. 729). The plaintiff claimed of the defendant a sum of three hundred pounds. On the 4th October 1771, plaintiff paid to defendant seventy-five guineas, on the condition that he the plaintiff should receive from the defendant a sum of three hundred pounds in case the Chevalier d'Eon should at any time prove to be a female. The cause was tried before Lord Mansfield, at Guildhall, and the jury found a verdict for the plaintiff, damages 300*l.*, thereby affirming that the Chevalier was a *female.* A motion was subsequently made on behalf of the defendant to arrest the judgment, or at least to stay the proceedings, on the ground that the action could not be supported, as being upon a wager tending to introduce indecent evidence, and also as being one which materially affected the interests of a third person. The question thus raised on the motion was argued before the Court of King's Bench, and the Judges unanimously agreed that the judgment must be arrested; the law not allowing wagers upon subjects leading to the introduction of indecent evidence (this being *contra bonos mores*), nor upon such subjects as are calculated to have an injurious effect upon the interests or character of a third person. Irrespective of this decision, the verdict was based upon what subsequently turned out to be untrue. The Chevalier was really a *male*, and not a female. He was carefully examined by Sir Anthony Carlisle, who satisfied all present of the perfect condition of the testicles. (See Paris and Fonblanque, vol. 1. p. 229.)

It would appear, from a singular case reported by Dr. Barry, that, in the United States, the rights of citizenship and the privilege of voting for members of Congress, have depended on the determination of sex. In March 1843, he was requested to examine the case of *Levi Suydam*, aged 23 years, a native of Salisbury, Con. At the exciting and warmly contested election of the spring of that year, almost everything bearing the semblance of the human form, of the male sex, is stated to have been brought to the ballot-box. It was at this time, and under these circumstances, that the above-mentioned person was presented by the Whigs to be made a free*man*; he was challenged by the opposite party on the ground that he was more a female than a male, and that, in his physical organization, he partook of both sexes. The following was the result of the *first* examination by Dr. Barry. There was a mons veneris covered with hair in the usual way; an imperforate penis, subject to erections, and about two inches and a half in length, with corresponding dimensions; the dorsum of the penis was connected by the cuticle and cellular membrane to the pubis, leaving about an inch and a half free, or not bound up, and towards the pubic region. This penis had a well-formed glans,—a depression in the usual place of the meatus urinarius, with a well-defined prepuce and foramen. The scrotum was not fully developed, inasmuch as it was but half the usual size, and not pendulous. In the scrotum, and on the right side of the penis, there was one testicle of the size of a common filbert, with a spermatic cord attached. In the perineum, at the root of the corpora cavernosa, an opening existed through which micturition was performed: this opening was large enough to admit the introduction of an ordinary-sized catheter. Having found a penis and one testicle, though imperfectly developed, Dr. Barry, without further examination, gave it as his opinion, that the person in question was a *male citizen*, and consequently entitled to vote and enjoy all the privileges of a free*man!*

On the morning of the first Monday in April (election day), Dr. Barry was informed that Dr. Ticknor would oppose Suydam's admisson on medical grounds. Suydam came forward: and Dr. Ticknor objected to him as a *female*, and therefore not entitled to vote. Dr. Barry then stated to the meeting, that, from an examination he had made, he considered the person in question to be a male, and requested that Dr. Ticknor might, with the consent of Suydam, retire into an adjoining room, and examine for himself. This was done, when Dr. Ticknor ultimately came to the conclusion that Suydam was a male. Suydam accordingly was admitted a freeman: and his vote was received and registered.

A few days after the election, Dr. Barry heard that Suydam had regularly menstruated. The sister of Suydam informed him that she had washed for him for years, and that he menstruated as regularly, but not so profusely, as most women. Suydam, when questioned, very unwillingly confessed that such was the fact. He was again examined by the two physicians, when the following additional particulars were elicited: — Said Suydam is five five feet two inches in height, light-coloured hair, fair complexion, with a beardless chin, and decidedly a sanguineous temperament, narrow shoulders and broad hips; in short, every way of a feminine figure. There were well-developed breasts with nipples and areolæ. On passing a female catheter into the opening through which micturition was performed, and through which, he again stated, he had a periodical bloody discharge monthly,—instead of traversing a canal and drawing off urine, the catheter appeared to enter immediately a passage similar to the vagina, three or four inches in depth, and in which there was a considerable play of the instrument. He stated that he had amorous desires, and that, at such times, his inclination was for the male sex: his feminine propensities, such as a fondness for gay colours, for pieces of calico, comparing and placing them together, and an aversion for bodily labour, and an inability to perform the same, were remarked by many. Dr. Barry further learned from an old lady, who was present at the birth of Suydam, that on the second day after his birth, Dr. Delamater, who attended as accoucheur, made with an instrument the opening through which he had ever since performed micturition. (American Jour. of the Med. Sciences, July 1847.)

This was certainly an embarrassing case,—one to which Lord Coke's rule for a decision, *i. e* the prevalence of either sex, is hardly applicable. The presence of a penis and one testicle referred the being to the male, while the bodily configuration, and still more strongly the periodical menstrual discharge, referred him to the female sex. The right of voting might have been fairly objected to, because, while the female characters were decided, the organs indicative of the male sex are described as having been imperfectly developed.

Dr. Hartshorne, the American editor of this work, quotes a case, in which an attempt was made by Dr. Gross, a surgeon in the United States, to destroy all sexuality, and thereby all rights of citizenship, in the case of an infant whose sexual organs were imperfect. (A report of this case will be found in the American Journal of Med. Sci. for Oct. 1852, and the Ed. Monthly Jour. for Jan. 1853.) The child, when seen by Dr. Gross, was three years of age, and had always up to that period been regarded as a girl, and in fact had been so pronounced at her birth by the accoucheur. At the age of two years she began to evince the taste, disposition, and feelings of the male sex: she rejected dolls and similar articles of amusement, and became fond of boyish sports. She was well-grown, perfectly healthy, and quite fleshy. Her hair was dark and long, the eyes black, and the whole expression most agreeable. A careful examination of the external genitals disclosed the following circumstances. There was neither a penis nor a vagina; but instead of the former there was a small clitoris, and instead of the latter a superficial depression or cul-de-sac covered with mucous membrane, and devoid of everything like an aperture or inlet. The urethra occupied the usual situation (in the female ?) and appeared to be natural ; the nymphæ were remarkably diminutive, but the labia were well developed, and contained each a well-formed testicle quite as large and as firm as this organ generally is in boys at the same age. The hips, chest, thighs, and upper extremities, were perfect. From this description it is pretty clear that the child was an *androgynus*, or there was imperfect development of the sexual organs, with predominance of those of the male. There was no indication of uterus or ovaries, nor any external peculiarity, except that which is frequently met with in hermaphrodites, in which there is an arrest of male development but no intermixture of the sexes. Dr. Gross considered that, for the child's future welfare and happiness, it would be better that it should have no testicles at all, than that it should retain them under such an imperfect development of the other organs. He therefore removed them by operation from the labia or divided scrotum, and had the dissatisfaction to find that they were perfectly formed in every respect, and that the spermatic cords were quite natural. The operation was performed in July 1849, and three years subsequently (in 1852) it was found that emasculation was complete, for the disposition and habits of the being had materially changed, and were those of a girl :—she was found to take great delight in sewing and housework, and she no longer indulged in riding sticks and other boyish exercises.

The reasons assigned for the performance of this operation—namely, the entire deprivation of sex, and thereby of any sexual feelings in after-life,—appear to me to be unsatisfactory. It is clear, from Dr. Gross's description, that this being was deprived of the rights and privileges of a *male* by the removal of the testicles. (See the case of *Levi Suydam*, *ante*, p. 654.) Dr. Gross appears to have contemplated the case only in a matrimonial point of view : but in a country where the rights of citizenship and power of voting for members of Congress are much valued, where they depend on direct proofs of sex, and are so strongly contested by opposing parties,—it is a serious question whether he has not here struck a severe blow at the political rights of these beings, in thus wilfully destroying the physical evidence of the male sex ! In this country it might have been a question whether he had not rendered himself liable in damages for thus tampering with the laws of nature.

Concealed sex.—It is almost superfluous to say that in some cases sex cannot be determined by the dress, appearance, or even voice of the individual. Cases in which males have passed for many years unsuspectedly as females, and *vice versá*, have been numerous. In some instances the secret has been disclosed only by death. Facts of this kind belong rather to the annals of imposture than to those of medical jurisprudence. A somewhat singular case of this description, that of *Eliza Edwards*, occurred to me in 1833. An unclaimed body was sent to Guy's Hospital, by the Inspector of anatomy, as a female. On removing the dress, however, it was found to be that of a *male!* From some suspicion respecting the cause of death, and the habits of this person, a Coroner's inquest was held. It turned out that the deceased, whose age was twenty-four, had assumed the dress of a female at the age of fourteen, and had performed in many parts of England as an actress. The features had a somewhat feminine character; the hair was very long, and parted in the centre; the beard had been plucked out, and the remains of this under the chin had been concealed by a peculiar style of dress. It was remarked during life that the voice was hoarse. The breasts were like those of a male, and the male sexual organs were perfectly developed. They had evidently been subjected to great traction, and appeared to have been drawn forward to the lower part of the abdomen. The state of the rectum left no doubt of the abominable practices to which this individual had been addicted. It was found that death had taken place from natural causes. The most remarkable circumstance in the case is, that the deceased had been attended in his last illness by an eminent physician (now deceased) for disease of the lungs; and so well was the imposition maintained, that his medical attendant did not entertain a suspicion of the real sex of his patient! (Med. and Phys. Jour. Feb. 1833, p. 168.)

IMPOTENCY. STERILITY.

CHAPTER 57.

IMPOTENCY—DEFINITION—PHYSICAL CAUSES.—PROCREATIVE POWER IN THE MALE—PUBERTY—CONVICTIONS FOR RAPE—AGE OF VIRILITY—LOSS OF VIRILE POWER BY AGE—DISEASES OF THE TESTICLES—POWERS OF CRYPSORCHIDES AND MONORCHIDES—SUPERNUMERARY TESTICLES—ARRESTED DEVELOPMENT—MORAL CAUSES.—STERILITY—CAUSES OF—PROCREATIVE POWER IN THE FEMALE—PUBERTY—EARLIEST AND LATEST AGES FOR CHILD-BEARING—FEMALE PRECOCITY—MENSTRUAL CLIMACTERIC—AGE FOR CESSATION—REMEDIABLE CAUSES OF STERILITY—LEGAL RELATONS OF THE SUBJECT—CONTESTED LEGITIMACY AND DIVORCE.

IMPOTENCY.

Definition.—Impotency is defined,—An incapacity for sexual intercourse. It may depend—1st, upon *physical*; 2nd, upon *moral* causes. With regard to the *moral causes* of impotency, they do not concern a medical jurist. Such causes are not recognized by law, and he has no duty to perform beyond the application of the principles of medicine to the purposes of the law.

Causes.—Impotency may depend on *age*,—on certain *physical causes*, *e. g.* disease,—or on congenital malformation or *defect*. With regard to *physical* causes, a distinction must be made between those which are remediable, and those which are not. The presence of disease of the testicle, such as atrophy or fungous tumours, may give rise to incapacity: but the incapacity may be sometimes removed by an operation or by medical treatment, and therefore the physical cause may be removed:—in other words, it is *remediable.* To such cases as these the law does not extend: but it is always expected, in alleged incapacity, that the practitioner examined on the subject should be able to say whether there is or is not a prospect of cure. Upon this point a knowledge of his profession can alone assist him: no rules can be laid down for his guidance, for there may not be two cases that will precisely resemble each other in their features. Hence it will be necessary to point out the chief causes of impotency which are of an irremediable nature, or those in which the incapacity is absolute and permanent:—a point upon which the law chiefly requires a medical opinion.

In strictness of language, the definition of impotency, as above given, may be applied to a *female* as well as to a male; and undoubtedly a physical incapacity for sexual intercourse may exist in either sex. As an instance of this incapacity in the female, may be mentioned occlusion or obliteration of the vagina—a condition not necessarily indicative of sterility. The mere occlusion of the vagina may be a remediable form of the malady; but its entire obliteration would be absolute and irremediable. This latter condition, however, is the only instance of complete impotency in a female. Protrusion of the uterus or of the bladder into the vagina, are mentioned by some writers as causes of physical incapacity for intercourse; but these forms of disease may commonly be remedied by art, and therefore require no further notice in this place.

In professional language, the term *impotency* has been hitherto applied exclusively to defect in the *male* sex; and the term *sterility* is confined to all those conditions in the female which not only render intercourse impossible, but which render it unfruitful. A male may, however, be sterile without being impotent, a condition observed in some crypsorchides; or he may be impotent without being sterile, as where proper intercourse is prevented by reason of physical defect.

Procreative power in the male. Puberty.—Until the period of puberty, the testes remain small, and increase very little in size in proportion to other parts. Mr. Curling found that the size of the seminal tubes differed but little at the ages of eighteen months and eight years. The sexual function in the male depends entirely on the development of these organs; but the age at which it appears differs in different individuals. The age of puberty in a healthy male in this country varies from 14 to 17 years; its appearance is, however, affected by climate, constitution, and the moral circumstances under which the individual is placed. In some cases it is not fully developed until the age of 21.

The access of puberty in the male is indirectly connected with the subject of rape. A boy under the age of *fourteen years* is presumed in law to be incapable of committing a rape. (1 Hale p. 631, and Mathew's Digest, p. 57.) This presumption is probably based on the supposition that a boy at that age is impotent. The statute law, however, now merely requires proof of penetration, and rape therefore may be physically perpetrated by a boy at or even under fourteen years of age. In *Reg.* v. *King* (York Winter Assizes, 1853), a boy aged 15 was convicted of rape on a girl under ten years of age. In a case elsewhere related (see RAPE, *post*, p. 694) a boy aged 19 communicated syphilis to a girl of six years of age. It appears that in India puberty shows itself much earlier in the male. Dr. Chevers, quoting from the Nizamut Adawlut Reports, states that a boy of 13 or 14 years of age was found guilty of rape and sentenced, in consideration of his youth, to three years' imprisonment. A lad of 14 was convicted of rape on a girl of the same age; and in another case a boy only *ten years* old was convicted of rape on a girl three years of age! He was sentenced to a year's imprisonment. (Med. Jur. for India, p. 463.)

The seminal secretion in the male is not considered to be prolific until it contains those peculiar filiform bodies which are known under the name of *spermatozoa* or zoosperms. These are regarded by some physiologists as parasitic animals, but by others, with some probability, as freely moving cilia. (Recent Advances, Baly and Kirkes, 1848.) All agree that they are normal and essential constituents of the healthy and prolific seminal fluid. They are peculiar to the spermatic secretion, and, in healthy males, are always present in it after the age of puberty. They disappear in certain states of disease, and sometimes in advanced age: they have not been found in the undeveloped testicles of crypsorchides. In cases in which they are absent from whatever cause, it is a fair inference that the individual is impotent, or that he has lost the power of procreation.

The direct agency of the spermatozoon in fecundation has been investigated by the late Mr. Newport. (Philos. Trans. 1853, vol. 143, part 2, p. 234.) I can here only briefly allude to his researches. His experiments were performed on the amphibia, by the aid of the microscope. It would appear from these (and his inferences are fairly applicable, within certain limits, to animals and man), that the presence of spermatozoa in the seminal secretion is indispensable to the impregnation of a female,—in fact, that the fecundating power resides in these living molecules. It is a curious fact, too, that active motion in the spermatozoon is essential to fecundation: thus, when these molecules are motionless or dead, ova are not impregnated by them; and the power of impregnation is in proportion to the activity of this motion. The impotency arising from advanced age in the human subject is probably not so much owing to a deficiency of spermatozoa in the male secretion, as to their power of motion being exceedingly feeble. We learn further, that impregnation was more certain when the quantity of spermatozoa supplied to the ovum was not reduced to a minimum: hence, whatever may be the precise quantity of the spermatic secretion necessary to effect healthful impregnation, it is thus proved that a definite quantity of spermatozoa, or spermatic influence, is required to fecundate. Exhaustion from any cause, and probably from venereal excess or self-abuse, may lead to a loss of procreative power, by reducing the number and diminishing the active motive powers of the spermatozoa. How it is that fecundation is effected by this incorporation of the spermatozoa with the ovum, it is impossible to say; but the embryo is not the product of the development of the spermatozoon. The nature of the change is a mystery which appears to be placed beyond the power of human research. The existence of sterility in the male, as well as in the female, and a want of procreative power in the sexes when the individuals are otherwise healthy, are to some extent explained by the results of Mr. Newport's researches. Without the penetration of the ovum there is no fecundation, and the conditions and circumstances which affect this result are very numerous.

In reference to the human ovum, there is an absence of that immediate contact with the male fluid which occurs in the amphibia. The human ovum may come into contact with the spermatozoa at the ovary, in any part of the Fallopian tube, or in the cavity of the uterus; but the spermatozoa may lose their active motion before reaching the cavity of the uterus or the tube; they may not be in sufficient number, or may not meet the ovum under circumstances favourable to penetration. It is probable that the ovum may maintain its vital power in the body of the female for a considerable time after its extrusion; and although the chances of impregnation may be thereby reduced, yet fecundation may occur if all other circumstances be favourable. This would explain the occurrence of conception at any time between two menstrual periods. (See *ante*, DATE OF CONCEPTION, page 610.)

Impotency from age.—It may be fairly assumed that a male is incapable of procreating until spermatozoa have appeared in the seminal secretion, and that he loses this power when they disappear. The *age* at which they are formed varies with all the causes that affect puberty. Mr. Curling has informed me that he found them in the secretion of a boy aged eighteen; but there is no doubt that in many cases they appear much earlier than this. This gentleman found spermatozoa in the liquid taken from the testicles of a man upwards of seventy years of age, and on one occasion in the testicles of a person aged eighty-seven. Wagner states that they are to be found in the secretions of men between seventy and eighty years of age. M. Rayer found them in the secretion of a man æt. eighty-two. (Gaz. Méd. Juin 2, 1849.) Other cases of a similar kind are recorded by Debrou. (Gaz. Hebdom. 4th Janvier, 1861, p. 6.) Facts tend to render it highly probable that the fecundating power may be retained by the male up to the age of 100. According to Dr. Duplay, the seminal fluid of old men contains spermatozoa, even when they are beyond the age for fecundation (Med. Times and Gazette, June 4, 1853, p. 581); but he does not state the circumstances which enabled him to arrive at this conclusion. Sexual propensities are often strongly developed in children, and they may be prolific at an early age. Dr. Rüttel met with a case in which a female at the age of fourteen became pregnant by a boy of the same age. (Henke, Zeitschrift der S. A. 1844, 249.) This is the earliest age at which, so far as I can ascertain, the procreative power has appeared in the male. Dr. Hartshorne, the American editor of this work, refers to a case of extraordinary development of the male sexual organs in a child four years old. (Amer. Jour. Med. Sci. Oct. 1852, p. 561.) In a case of contested legitimacy or affiliation, this question regarding the age at which a procreative power may appear in the male may have an important bearing. Thus the person may be so *young* as to render it impossible that he should be the father of a child imputed to him. Cases involving questions of legitimacy on this ground are not heard of in the present day: but in ancient law books there are decisions relative to the illegitimacy of children born during marriage, because the alleged fathers were seven, six, and even three years old! (Amos.)

The following case in reference to the affiliation of children occurred in 1840: — A woman wished to affiliate a child on a youth who was in his *sixteenth* year. The boy denied that he was the father of the child; and there was reason to suspect that the imputation had been wrongly thrown upon him in order to divert suspicion from the real party. There was some difficulty in this case; but it appears to me that the rule for a medical man to follow on these occasions is this: — not to regard the mere *age* of the youth, whether he is above or below the average age of puberty, but to observe whether the sexual organs are fully developed, and whether there are about him any of the ordinary marks of virility, indicated by muscular development, the growth of a beard, and a change in the voice. If these signs are present, whatever may be his age, there is strong reason to suppose that the sexual functions are developed. We occasionally hear of instances of extraordinary precocity: but the development of sexual power is generally accompanied by other well-marked changes in the individual. Sometimes these changes do not make their appearance until after the age of twenty-one.

On the other hand, it may be a question at what time the procreative power disappears in a male. That impotency is one of the natural consequences of *advanced age* is undoubted: but this, as we know, forms no legal impediment to the marriage of parties however old. The legal presumption is, that the generative faculty does not disappear through age: and if this be alleged, and legitimacy disputed on this ground, it must be satisfactorily proved. This amounts to almost an impossibility: because it is well known that there is no fixed age at which the sexual functions cease either in the male or female: and individuals, at least of the male sex, who had passed the ages of sixty, seventy, and even eighty years, have been known to be capable of intercourse and to be prolific. M. Duplay believes, from his anatomical observations on the bodies of aged persons, that the causes of impotency (sterility) in advanced age are to be found rather in the excretory than in the secretory apparatus. Thus he has met with obliterations in the canal of the epididymis, the vas deferens, and the vesiculæ, the effect of which is to prevent the accumulation and passage of the seminal fluid. (Med. Times and Gazette, June 28, 1856, p. 650.) Lord Erskine, in the Banbury Peerage claim, quoted the case of Sir Stephen Fox, who was married at 77, and had four children, the last when he was 81. Dr. Schneider met with a case in which a man of 71 had a child by his wife, who was only 17. (Henke, 1842, vol. 2. p. 165.) Dr. Rüttel mentions the case of a man, who, at the age of 92 years, married and had two children by his wife! When the procreative power even appears to be lost at an advanced age, the stimulus for intercourse is often very great. The same authority mentions cases in which these erotic feelings were remarked by him in reference to men between 75 and 86 years of age. (Henke, Zeitschrift, 1844, p. 252.) In all cases of protracted virility it is observed that the bodily and mental powers are also retained in an extraordinary degree, showing the close relation which exists between sexual function and corporeal development, even to the latest period of life.

The English law on this subject was clearly laid down in the *Banbury Peerage case*, brought before the House of Lords in 1806. Lord and Lady Banbury had been married twenty-one years without having had issue, when his lordship died at the age of 85 years. The peerage was claimed by the descendants of an individual who called himself the son of Lord Banbury; but in fact it was alleged that he was the son of Lady Banbury by an adulterer, during her husband's life. According to the evidence, Lord Banbury did not appear to have been aware of his existence: and the child had always been known by another name. (Amos, Med. Gaz. vol. 7. p. 741.) One of the grounds upon which the legitimacy of the descent of the claimant was contested was, that the deceased nobleman had become impotent through *age*; but it was argued by Sir S. Romilly, that the law placed no limit on the powers and faculties of men. The assumed impotency of the alleged parent on the ground of age, could never be admitted as a proof of the illegitimacy of the supposed offspring. In 1813 the House decided against the claim, but not on the ground of impotency from age in the husband. It was proved that Lord Banbury was hale and hearty at the time of his death; but the moral circumstances of the case, especially the *concealment* of the birth of the child from the husband, were considered to be sufficient to prove that the child through whom the claim was made, was not the offspring of Lord Banbury. This case incontestably proves that there may be capacity of intercourse, and possibility of access on the part of a husband, yet every species of moral evidence will be admitted to rebut the legal presumption of legitimacy when there are reasonable grounds for disputing it. Sir S. Romilly remarked, in reference to the retention of procreative power in advanced age, that the liberality of the English law on this subject was excessive, for there was no age, from *seven* upwards. at which a man had been denied the power of procreating children! (See, in reference to this subject, Henke. Zeitschrift der S. A. 1842, p. 332.) Males at the age of 14 and females at the age of 12, are legally competent to contract marriage.

Impotency from local disease or accident.—The loss or destruction of the penis or testicles, either by disease, accident, or from necessary operations, would be sufficient to render an individual irremediably impotent. The loss of one or both testicles from any of these causes would be indicated by the presence of distinct cicatrices in the scrotum. When both have been removed by operation, the person is incurably impotent: but if the organs are healthy, a sufficiency of the spermatic fluid to confer procreative powers may remain in the ducts for two or three weeks after the operation. Thus it is that animals have been known to be prolific for a certain time after castration: and one case is on record in which a man, both of whose testicles had been carried off by a gun-shot, is said to have retained the power of impregnating his wife after the healing of the wound. (See a paper by Dr. Krugelstein, Henke's Zeitschrift, 1842, vol. 1, pp. 348 and 352.) The loss of *one* testicle only, by accident or operation, does not render a man impotent. *Monorchides*, as they are called, have been known to be prolific. Cases of this kind must not be confounded with those in which one or both testicles have not descended into the scrotum. In some rare instances, the organs do not descend into the scrotum at the usual period: but one or both may remain in the abdomen, or in the inguinal canals, and only descend some time after birth: or one may be found in the scrotum, and the other remain during life in the abdomen: or both may be retained in the abdomen. In some cases of partial descent the organs have been mistaken for, and treated as, ruptures by the application of a truss! (Henke, Zeitschrift der S. A. 1844, vol. 1. p. 249. Curling on Disease of the Testis, 2nd ed. p. 31.) In one instance the attempt to reduce the tumour, mistaken for hernia, and the application of a truss, caused the death of the person. (Med. Times and Gaz. March 2, 1861, p. 240.) When one testicle only has descended, there is no ground, *cæteris paribus*, to impute impotency. The descended organ has been found healthy and to contain spermatozoa, while the retained testicle and its ducts have not been found to contain spermatozoa.

(Med. Times and Gaz. Feb. 23, 1861.) When neither has descended, the scrotum will be found empty, without any cicatrix, but the other marks of virility may still be present. These persons have been called *Crypsorchides.* It has been stated that in such cases the testicles are to be regarded as congenitally defective; and further that the individual, although capable of intercourse, is incurably sterile.

The non-descent of the testicles is a state rarely seen. Mr. Marshall met with only one case of non-descent of one testicle in 1000 recruits, and with one case of non-descent of both testicles in 10,000 recruits. There are three preparations showing the non-descent of the testes, in the museum of Guy's Hospital; one of them was taken from a gentleman who shot himself from despondency at his supposed defective condition. Hunter thought that the undescended testicles were always imperfect both in their structure and functions, and that crypsorchides were invariably impotent (sterile). There are some facts on record which are adverse to this opinion. Mr. Cock has informed me of the cases of two men whose testicles had not descended, and in whom the virile functions were perfect. One of them, before he had reached the age of thirty years, had already married twice, and had had children by each wife, besides illegitimate children which were affiliated on him during the time he lived in service! In these cases it will be found that the usual signs of virility have appeared about the person. The recent researches of Godard, Curling, Partridge, and others have, however, proved that in various cases which have come before them, the organs when retained in the abdomen were imperfect, and the fluid contained in them presented no appearance of spermatozoa. In January 1860, Mr. Partridge communicated to the Pathological Society the case of a man of twenty-five, in whom both testicles were found in the abdomen. Several specimens of the secretion were examined, and no spermatozoa were detected. Another case had been examined with a like result (Lancet, Jan. 1860, p. 66), and a third, by Mr. Curling. (Med. Times and Gaz. Feb. 23, 1861.) The conclusion to which these recent observations lead, is, that although in cases of non-descent there may be a capacity of intercourse, the person is generally sterile. Sterility, or incapacity of procreation, is not, however, a necessary condition in crypsorchides, as Hunter supposed. The cases above cited as having fallen under the observation of Mr. Cock and another, recently published by M. Debrou, of Orleans (Gaz. Hebdom. Jan. 1861), are sufficient to show that each case must be guided by the circumstances which accompany it. No absolute law can be laid down regarding the presence or absence of prolific power in such persons. M. Godard, of Paris, has noticed among animals, that horses whose testicles were retained in the abdomen were sterile, but capable of intercourse. If, in a case of non-descent, there should be a non-development of the other external organs, and this is accompanied by a total want of the characters of virility, no doubt can be entertained that the person is irremediably impotent. The testicles may, in such a case, be either congenitally absent, or physically imperfect — a fact only ascertainable by an examination after death. Hence, in cases where there are no external marks of effeminacy, or other grounds for suspecting a want of procreative power, and the person is capable of intercourse, this imperfection does not offer any bar to marriage, nor is it a ground for divorce. It would not justify a medical man in denying the paternity of a child on a question of affiliation, bastardy, or inheritance: and so long as the power of sexual intercourse existed, the retention of the testicles in the abdomen would not probably be considered a lawful ground of divorce by reason of presumed sterility.

The presence of what have been called supernumerary testicles does not affect the virile powers of the individual. These have in general been found, by dissection, to be tumours connected with the healthy glands, and not at all adding to or interfering with their functions. Even the presence of two or three penes, according to Mende, is no bar to the exercise of sexual power, provided only one possesses the normal characters of the male organ. This author refers to cases of duplex organs. (Ausführl. Handb. d. ger. Med. vol. 4. p. 337.)

In some instances there is an arrest of development in the external organs: and with this there is generally an absence of sexual desire. Mr. Farr met with a case in a man aged forty-two, in whom the sexual organs remained undeveloped and in an infantile state. There was some difficulty in finding the testicles, in consequence of their small size. On examining the contents of the glands microscopically, no spermatozoa were found. This person's voice was effeminate, and he was devoid of hair on the chin and pubes. (Med. Gaz. vol. 40, p. 857.) It is not, however, always to be inferred that a male with undeveloped organs is incurably impotent. The following case is quoted by Mr. Curling: A gentleman, aged twenty-six, consulted Mr. Wilson on the propriety of his entering into marriage. His penis and testicles but little exceeded in size those of a youth eight years of age, and he had never, until this acquaintance with his intended wife, felt the desire of sexual intercourse. He married, and became the father of a family: and at the age of twenty-eight the organs had attained the full development of those of an adult. (Op. cit. 25.) Under wasting of the testicle, or when the gland is extensively diseased, and the sexual desire disappears, there can be no doubt of impotency. The functions of these organs are not, however, readily impaired by local disease. The spermatic secretion is still properly formed, even when only a small part of the gland remains healthy,—a fact proved by a microscopical examination. Certain diseases of the appendages of the testes may, however, render a person impotent. The spermatic secretion is commonly suspended in most severe diseases which affect the body.

A frequent cause of impotency (sterility) in the adult, when the organs are apparently sound, is spermatorrhœa, arising from abuse. This, however, is remediable to a greater or less extent by treatment. (See Curling, Diseases of the Testes, 2nd ed. p. 386; also Med. Times and Gazette, Jan. 23, 1858, p. 95.)

On the absence of the penis, as well as on its defective organization, as causes of incapacity, some remarks have been already made in the preceding section. Sometimes the defect is merely connected with the urethra. Thus the orifice may be on the dorsum penis, and in other cases underneath the organ, so that the urethra may terminate at a variable distance from the glans penis. Those labouring under the former defect are said to have *epispadia*; and under the latter, *hypospadia*. The power to have fruitful intercourse will in either case depend on the situation of the urethral aperture. Rüttel knew an instance of an hypospadian having several children. (Henke, Zeitschrift, 1844, p. 258.) Some doubt has existed respecting the virile powers of those who are affected with hypospadia. In September 1850, a lad, aged seventeen, was summoned before the magistrates of Kidderminster on a charge of affiliation, in reference to the pregnancy of a girl aged eighteen. The defence was, that he could not be the father of a child, because there was such a malformation of the penis as to prevent prolific intercourse. On examination, the urethra was found to terminate on the under surface of the penis, about an inch and a half from the glans, by a small elliptical orifice, which allowed the urine to pass, but with some difficulty. One medical witness gave it as his opinion, that it was not impossible, but highly improbable, that the defendant should possess procreative power; another freely admitted the boy's capacity, and the case was decided against him. (Med. Times, Sept. 21, 1850, p. 321.) There can be no doubt that this was a correct decision. When the urine can pass, the seminal fluid can pass, and the only question is, whether the intromission can be such as that the misplaced orifice should come in contact with any part of the vagina. This must depend on the situation of the orifice. [Cases illustrative of the fully prolific powers of hypospadians will be found in the Med. Times, Sept. 14, 1850, p. 292; and Oct. 12, 1850, p. 392. An instance of the virility of a hypospadian has been published by Mr. Noble, of Manchester, in the Assoc. Med. Jour. March 18, 1853, p. 236.] Similar remarks apply to epispadians. These malformations are sometimes remediable: but whether remediable or not, they are not, under any circumstances, to be regarded as absolute causes of impotency.

The incapacity for intercourse in either sex may arise from *extensive disease* affecting parts in and around the organs of generation. The medical opinion here must be regulated entirely by the circumstances attending each case.

Impotency from general disease.—In the preceding paragraphs the influence of local disease in affecting virility has been considered. But there is a class of cases which may come before a practitioner, in which, with well-formed organs in the male, there will be a state of impotency. Sometimes this may depend on natural weakness of constitution, or on a want of proper development of the muscular and nervous systems: at other times it is due to certain diseases, and it is then of a temporary nature, persisting while the body is still suffering from the disease, and disappearing on recovery. As a converse fact, there are certain diseases which appear to bring out the dormant virile powers of persons, or to excite to a higher degree of intensity those which already exist. Thus it is said that in convalescence from fever, there is occasionally extraordinary salaciousness: but this statement requires confirmation. Again, there are some diseases which neither interrupt nor affect the exercise of the sexual functions.

As a general rule, diseases which do not affect the brain and spinal marrow, and which are not attended with great debility, do not prevent fruitful intercourse. On the other hand, diseases which are attended or followed by great debility, suspend or destroy sexual power. Among these diseases may be mentioned—water in the chest, general dropsy, especially if attended with effusion in the sexual organs,—nervous and malignant fevers which affect the brain,—apoplexy, palsy, and other diseases which directly attack the brain or spinal marrow. These last-mentioned diseases probably act by suspending the secretion or altering the nature of the prolific fluid, as well as by preventing that erection of the male organ, without which intercourse cannot take place. The sexual function is so intimately allied to bodily vigour and nervous energy, that the integrity of the one may be pronounced to be essential to the integrity of the other. Habits of drunkenness and the abuse of alcoholic liquids may give rise to impotency by the injury done to the brain and nervous system. (The reader will find this subject fully discussed by Mende, Ausführl. Handb. der ger. Med. vol. 4. p. 349.)

Mr. Curling observes that diseases and injuries of the spinal cord producing paraplegia have no direct effect on the testicles, but destroy the power to copulate (Op. cit. p. 371). When there is a wasting of the testicles as a result of general paralysis of long standing, there can be no doubt of impotency: but Mr. Curling quotes a case from a foreign writer, in which under paralysis (paraplegia) of some years' duration, a man retained sufficient sexual power to have prolific intercourse.

When the paralytic person is advanced in age, it is highly probable that he is impotent. In December 1857, a case was referred to me in a question of bastardy for my opinion on the capacity for intercourse under the following circumstances. A woman required an order of affiliation on the putative father of her bastard child. She was a widow, and the illicit connexion took place about two months before her husband's death. The husband was eighty-four years of age, was bed-ridden, and for many weeks before his death could not move in his bed, and was unable to pass his urine without assistance. The medical opinion of those who examined him was that he was impotent from physical infirmity, and in this opinion I concurred, stating, however, that unless the male organs were diseased or destroyed, it could not be said that intercourse was impossible. It was, however, wholly improbable that the husband should have been the father of the child.

Some diseases appear to have a specific influence on the development of the sexual organs: and although not influencing the nervous system — not affecting the sexual organs directly, nor leaving any trace of constitutional disturbance — they lead to an arrest of sexual development, and therefore to impotency and sterility. One disease has been especially noticed as possessing this influence, namely, *cynanche parotidea*, or mumps. Sir Astley Cooper was accustomed to state in his lectures, that on the subsidence of this disease, when it attacked adolescent males and females, the testicles in the male and the breasts in the female became occasionally inflamed. The organs shrank and slowly withered. Their development was arrested, and in the male incurable impotency was the result. Dr. Krugelstein refers to a case in which a strong and healthy man was rendered incurably impotent after an attack of this disease. (Henke, Zeitschrift, 1842, vol. 2. p. 354. See also Curling, Op. cit. p. 59.)

Blows on the head or spine, by affecting the brain and spinal marrow, may produce impotency. Several cases of impotency from this cause are related by Curling (Op. cit. p. 362). It has been noticed that blows on the under and back part of the head, in the region of the cerebellum, have been followed by loss of sexual power on recovery. Sometimes this is temporary; but at other times when there is wasting of the testicles it is permanent and irremediable.

Of *moral* causes it is unnecessary to speak. The sexual desire, like other animal passions, is subject to great variation; and there are instances on record, in which men, otherwise healthy-looking and healthily formed, have experienced no desires of this kind. They are in a state of natural impotency: a condition which the Canon law designates as frigidity of constitution. This is not to be discovered by examination, but rather from their own admission. Under this head we may class hypochondriacal affections. [For a valuable scientific summary of the causes and treatment of impotency, I must refer the reader to the work of Mr. Curling, Diseases of the Testis, 2nd ed. p. 359, 1856.]

STERILITY.

Definition.—Sterility is usually defined to be "the inability to procreate, or a want of aptitude in the female for impregnation." It is not usual to speak of sterility in the male, although there may be procreative incapacity; because the defective condition in this sex, from whatever cause, has been hitherto included under the term impotency. In the strictness of language, a male who has been castrated is sterile; but it is commonly said that he is impotent. Many apparently well-formed males may be sterile without being impotent, *i.e.* that they may have intercourse without procreating,—for the power to copulate must not be confounded with that of procreation. Mr. Curling has pointed out that any cause of obstruction in the vasa deferentia may render a male sterile, although he may retain a power of intercourse, and thus cannot be regarded as impotent (Diseases of the Testis, ed. 2, p. 216). Some crypsorchides may be sterile, or deficient in procreating power, while at the same time impotency or incapacity of intercourse may not exist. In reference to the female sex, sterility implies that condition in which there is an "inability to conceive." This appears to be the true meaning of the term, and the sense in which it is used, not only by the best writers, but in common phraseology.

Procreative power in the female. Puberty.—In the *female*, the procreative power is supposed not to exist until after the commencement of menstruation, and to cease upon the cessation of this periodical secretion. The menstrual function is commonly established in females in this climate between the ages of *fourteen and sixteen*; but it may occur much earlier: indeed, in some rare instances, a discharge resembling the menstrual has been known to occur in mere infants. In other cases its appearance has been protracted to a much later period. According to Dr. Rüttel, the menstrual function appears in the smallest number of females at 12, 13, and 14 years, and in the largest number at 16, 17, and 18. In many it is only first established at from 19 to 21 years; and he states that at this age he has often found the uterus small and quite undeveloped. Perhaps, in this country, the most frequent age for the commencement of menstruation may be taken at 15 years. It is liable to be accelerated in its appearance by certain moral and physical conditions under which a female may be placed. According to Dr. Chevers, females in India begin to menstruate after the twelfth year or at the beginning of the thirteenth, and the function continues until the fortieth or even the forty-fifth year. Menstruation at ten years is very uncommon, and probably does not occur in more than one or two instances out of a hundred females. It is equally rare that it should be delayed beyond the thirteenth year. (Medical Jurisprudence for India, 1856, p. 461.) The most common intervals for the appearance of this function are twenty-eight and twenty-one days. It is sometimes late in life before it appears. Dr. Camps found that it had not appeared in a married woman, æt. thirty, who had borne no children. (Med. Gaz. vol. 32, p. 409.) Another case is mentioned in the same volume where it appeared for the first time at the age of 47 (p. 567). So soon as this function commences, the female may be considered to have acquired procreative power; but a female may conceive before the function has commenced, during the time of its occurrence, or after it has ceased. From facts elsewhere stated (*ante*, p. 610) there is reason to believe that the period which immediately precedes or follows the discharge is favourable to conception: although the experience of most accoucheurs has proved that impregnation may take place at any period between one menstruation and another.

It is important to remember that these changes in the uterus may produce remarkable effects by sympathy with the brain and nervous system. At or about the time of puberty, especially if any cause of obstruction exist, females become irritable, easily excited, and they have been known to perpetrate, without motive, crimes of great enormity, such as murder and arson. A propensity to steal is also stated sometimes to manifest itself. (See *post*, KLEPTOMANIA.) It has been remarked that acts of arson have been frequently committed by girls at this period of life, and the crime has spread by imitation. The case of *Brixey*, tried for the murder of an infant, and acquitted on the ground of insanity, will serve as an illustration of the morbid effect produced on the brain by disordered menstruation. (See *post*, INSANITY.) The state of the mind should be therefore carefully watched at this period of life: and any causes of violent excitement removed. Irregularity, difficulty, or suppression of the menstrual secretion may give rise to temporary insanity. Puberty in the *male* may be attended with similar morbid propensities; but these are not so commonly witnessed as in the female sex.

Pregnancy before menstruation.—The occurrence of menstruation is not indispensable to pregnancy. Many cases are on record in which women who had never menstruated have conceived and borne children. One case is reported, in which a female, aged 25, became pregnant and bore a child, and menstruation was only regularly established afterwards. (Lancet, Feb. 1842.) Dr. Murphy mentions another case of pregnancy previous to menstruation, in a woman aged 23. (Obstetric Reports, 1844, p. 7.) Numerous cases of conception without previous menstruation are quoted by Capuron (Méd. Lég. des. Acc. 96); and no fewer than nine instances of pregnancy before menstruation have been collected by Mr. Whitehead. The females were all in excellent health during the whole time, and one did not menstruate until more than two years after the marriage had been consummated. (On Abortion, p. 223; see also Orfila, Méd. Lég. 1848, vol. 1. p. 257.) Another case will be found reported in the Medical Gazette (vol. 44, p. 969). Dr. W. Taylor met with a case in which a female aged 13 bore a child before menstruation had appeared. (Med. Times and Gazette, March 12, 1853, p. 277; see also, for remarks on this subject, Ed. Monthly Jour. July 1850, p. 73.) The late Dr. Reid has stated that a patient of his bore a child at the age of seventeen without having previously menstruated; and he has collected a number of cases, from various authorities, of pregnancy occurring in females who had not menstruated. (Lancet, Sept. 3, 1853, p. 296.)

According to Bischoff, the uterine discharge of blood in menstruation is only a symptomatic, although usually a constant, appearance. But it may be absent, while the ovarian changes go on in the usual way: hence a non-menstruating woman may conceive. At the menstrual period the uterus undergoes certain changes; the mucous membrane is swollen, and the uterine glands are strongly developed: hence the expelled ovum finds a ready spot of attachment when impregnated; and an absence of this swollen condition of the mucous membrane at other times may be one cause of sterility. From an inspection of the generative organs in the human female, in thirteen cases, during or shortly after menstruation, he infers that the change in the uterine mucous membrane is synchronous with the commencement of menstruation, and it has been observed to remain for so long a period as eighteen days after this function had ceased. The true function of menstruation appears to be the ripening and separation of the ovum. (Med. Times and Gazette, April 8, 1854, p. 354.)

Instances of *premature puberty* in the female are now numerous: they are far more common than in the male sex. Mr. Whitmore met with the case of a female child who, from a *few days* after birth, menstruated regularly at periods of three weeks and two or three days, until she had attained the age of four years, when she died. On inspection after death she appeared like a much older girl. The breasts were unusually large, and the female organs and lower limbs were considerably developed. (North. Jour. Med. July 1845, p. 70.) Another case is reported in the Lancet (Jan. 29, 1848, p. 137).

This was a child aged three years. The breasts were as healthily developed as in an adult of twenty years; and the female organs were also as much developed as in a girl at the age of puberty. It was found that this child, who had been regularly menstruating for twelve months, had the appearance of a little old woman. (For other cases of menstruation at five years, see Med. Gaz. vol. 25. p. 548; at three years, vol. 47. p. 244; and at three years and a half, Med. Times and Gaz. July 24, 1858.) In these instances there is great reason to believe that procreative powers are early developed; but it is not common to hear of such young females becoming impregnated. A case is mentioned by Dr. Beck, in which a female menstruated at one year; she became pregnant, and was delivered of a child when little more than *ten years* old. Dr. Walker met with a case in which the menstrual function was established at the age of eleven and a half years, and the patient was delivered of a living child when only twelve years and eight months old. (Amer. Jour. Med. Sci. Oct. 1846, p. 547.) In another, observed by Rüttel, already referred to, a female of the age of *fourteen* became pregnant by a boy of the same age. He also quotes three others, where one girl of the age of *nine*, and two of the age of *thirteen*, became pregnant. (loc. cit.) The first of these three cases represents the earliest age for pregnancy yet assigned by any author.

I am indebted to Sir Eardley Wilmot for the particulars of a case (*Reg.* v. *Chattaway*) which was the subject of a trial on the Midland Circuit. At the Coventry Summer Assizes, 1848, he conducted a prosecution against a man, æt. forty-five, for a misdemeanour in having had carnal knowledge of a girl named *Sprason* between the ages of ten and twelve years. When intercourse was first had, the girl was *eleven years and eight months old*; it was repeated several times subsequently: and when the prosecutrix gave her evidence in Court, it appeared from the statement of the mother that the child was in the last month of her pregnancy: she was then not quite twelve years and six months old. Sir E. Wilmot ascertained by inquiry that menstruation had commenced in this girl at the age of *ten years and two months*, and had continued regularly up to December 1847, which was about the time when she first had intercourse with the prisoner. It appeared that she was a factory girl; and to the heat, confinement, and association with males, to which girls are subjected in this employment, may be referred the early commencement of puberty. When menstruation has thus commenced, conception may always be the result of sexual intercourse. The prisoner was convicted, and sentenced to two years' imprisonment with hard labour. The reader will find some additional particulars in reference to this case, by Mr. Smith, of Coventry. (Med. Gaz. vol. 42. page 751.)

Age at which menstruation ceases. Menstrual climacteric.—The average period at which this function ceases in the female is usually at the age of from forty to fifty years: but as it may commence very early, so it may continue very late in life. In one case it has been known to cease at the age of twenty-three; and in other instances it has continued to the age of sixty-six and even of seventy-five years. (Whitehead, op. cit. 145, et seq.) Dr. Royle describes three cases, in two of which menstruation continued up to the age of sixty-seven. (Med. Times and Gaz. Nov. 1860.) Mr. Thomas met with a case in which a woman had ceased to menstruate at the age of forty-five, but the discharge suddenly reappeared after an attack of illness when she had reached the age of sixty-nine. The discharge appeared several times, but not with monthly periodicity. It seems that her mother and sister had also menstruated at the ages of sixty-nine and sixty. (Med. Times and Gazette, Aug. 7, 1852, p. 148.) In a case which occurred to Capuron, it continued beyond sixty (op. cit. p. 98); but a more remarkable case, both of late menstruation and late pregnancy, is quoted by Orfila from Bernstein. A female in whom the function appeared at twenty, menstruated until her ninety-ninth year. Her first child was born when she was forty-seven, and her seventh and last when she was sixty. (Méd. Lég. 4ème éd. 1848, vol. 1. p. 257: see also Briand, Man. Complet de Méd. Lég. 1846, 137.) From these facts, it is clear that it is impossible to fix the age of a female by the period at which this "change of life" occurs. At the best, it can only be an average of a certain number of instances. This question arose in the case of *Clark* v. *Tatom* (Kingston Lent Assizes, 1848), in reference to the identity of a female, through whom property was claimed by the husband, who was the plaintiff in the action. The marriage had taken place in 1794; the parties separated in 1809: and the plaintiff's wife, as it was alleged, died in 1843, when, by direction of the defendant, the age of fifty-five was put upon the lid of her coffin. A medical gentleman who attended her in 1841, deposed that from being then in her menstrual climacteric, he should consider her not to have been more than fifty at that time. He stated that the *general* period for the cessation of menstruation was forty-four; it was rarely protracted to the age of fifty. On this assumption, it was impossible that the deceased could have been the plaintiff's wife, because at the time of the alleged marriage she would have been only *three years old!* On the part of the plaintiff, direct evidence was given to show that the deceased was his wife: and it therefore remains to be considered whether the adverse medical opinion is or is not consistent with medical experience. It is obvious from the cases above quoted, that menstruation may continue to sixty-six or seventy years of age, and that this may have been an exceptional instance. The plaintiff had a clear right to this medical presumption in his favour; and admitting that his wife was seventeen at her marriage, she would have been menstruating in her sixty-sixth year. Hence it is evident that the medical facts of the case were compatible with the evidence adduced on the part of the plaintiff. At the trial, those well-known exceptional cases of menstruation beyond the fiftieth year were not even referred to: nevertheless the jury returned a verdict in favour of the plaintiff.

Is it possible for a female to become pregnant after menstruation has ceased? — It is commonly asserted and believed that, after the cessation of menstruation, a woman is sterile. This is doubtless the general rule; but in a medico-legal view it is necessary to take notice of the exceptions. Mr. Pearson, of Staleybridge, communicated to the Lancet, some years ago, the case of a lady, aged forty-four, who, up to September 1836, had given birth to nine children. After this, the menses appeared only slightly at the regular periods until July 1838, when they entirely ceased. Owing to this, she supposed that she was not liable to become pregnant; but, on the 31st December 1839, therefore eighteen months after the entire cessation of the menses, she was delivered of her tenth child. Hence conception must have taken place at from eight to nine months after the final cessation of the discharge.

Latest age for pregnancy.—The age at which women cease to bear children is usually from forty to fifty years; but as they may menstruate, so they may conceive, beyond the last of these periods. Besides, the facts above mentioned show that the continuance of menstruation is not absolutely necessary for conception. Numerous instances are on record of females advanced in life, bearing children. A case is reported in which a well-formed female, who had been married nineteen years did not bear a child until she had reached the age of *fifty*. (Schmidt's Jahrbücher d. Med. 1838, S. 65; Henke, Zeitschrift, 1844, S. 251.) In this case it is stated that menstruation had ceased two years before conception. Rüttel observed in twelve women that they bore their last children at ages varying from forty-five to fifty. Ottinger met with an instance of a female bearing a child at fifty; Cederschjald with another, where the woman was *fifty-three*, and menstruation still continued. Haller records two cases in which women at *sixty-three* and *seventy* respectively bore children. (Briand, Man. Complet de Méd. Lég. p. 137.) Nevermann has drawn up a table in reference to the late ages of life in which women have borne children. Out of 1000 cases in 10,000 births, he found that 436 children were borne by females at the ages respectively—

Of 41 years	101	Of 48 years	8
42	113	49	6
43	70	50	9
44	58	52	1
45	43	53	1
46	12	54	1
47	13		

A case has been communicated to the Med. Gaz. (vol. 39. p. 950) by Dr. Davies, of Hertford, in which a woman was *fifty-five* when her last child was born. She menstruated up to that time. In *Lord* v. *Colvin* (Vice Chancellor's Court, July 1859), one of the questions raised was whether a woman æt. 52, who had been married thirty years without having children, had passed the age of child-bearing. Her issue would take the benefit of certain property under a will. It was decided that the female had not reached an age at which it could be said to be impossible that she might bear children.

We cannot pretend to fix the age beyond which pregnancy cannot occur. Questions of this kind have an important bearing on the subject of legitimacy; and unless the law looks to something more than ordinary experience in such matters, the decisions of Courts must be inequitable. The legitimacy of the claimant of the *Douglas Peerage*, about the middle of the last century (*ante*, p. 535), was contested among other grounds, on the presumed loss of procreative power in the female said to be the mother, who was in the fiftieth year of her age at the time of the alleged birth, and who therefore must have conceived when in her *forty-ninth year*. Lords Camden and Mansfield justly decided that this was no objection to the legitimacy of the appellant. The fallacy of trusting to a ground of this kind as evidence of illegitimacy is proved by a reference to the numerous cases already quoted. One somewhat similar to that of the Douglas Peerage occurred in France in 1754. *François Fajat* claimed an estate as heir to his mother. His claim was resisted on the ground that, according to the baptismal registry, his mother could not have been the legitimate heiress of the party through whom the claim accrued: because her alleged mother would then have been in her *fifty-eighth* year: and this, it was alleged, was beyond the age of child-bearing. Ancient records were searched, and the claim of legitimacy was admitted, because menstruation and conception had been known to occur at periods of life even later than this. (Capuron, Méd. Lég. des Accouch. p. 93.) This author quotes a case in which a healthy woman menstruated until she had passed her *sixtieth year*, and her last child was born when she was *sixty years* of age. (98.) Other cases of births at the age of sixty-three and sixty-five are referred to; but these appear to be of a less authentic kind. The truth is, in giving a decision, the law is bound to look to the anomalies connected with the exercise of the generative function; and therefore the limited experience of a few witnesses, casually taken, can hardly be expected to supply satisfactory answers to questions of this kind. It establishes no presumptions respecting the presence or absence of this power at any period of life ; it leaves each case to rest upon the whole of the circumstances which attend it.

Causes of sterility.—The causes of sterility in the female system are very numerous. Some of them depend upon peculiarities of constitution, the sexual organs being well formed and developed,—others upon latent changes or congenital defects in the uterus and its appendages, only discoverable by an examination after death. Sterility rarely becomes a medical question in contested cases of legitimacy; for a claim on the part of an individual to be the offspring of a particular woman, unless the female were in collusion with the claimant, could only be made after her death ; and if not disproved by medical evidence, showing that the woman could not have borne children, it would in general be easily set aside by circumstances. If the uterus, ovaries, or other parts were congenitally defective or absent, or if there were external sexual malformation, accompanied by occlusion or obliteration of the vagina, a medical witness could have no difficulty in saying that a woman must have been sterile. (See Med. Times and Gazette, Jan. 23, 1858, p. 96.) A mere occlusion of the vagina, removable by operation, does not necessarily indicate sterility, for the internal parts may be healthy and sound. In some instances, the ovaries or the uterus may be entirely absent, or the Fallopian tubes may be obliterated,—conditions which cannot in all cases be determined during life; in other instances, these organs may exist, but be defectively developed. Dr. Coley relates a case in which, in a female æt. twenty-six, it was found after death that the uterus was not larger than in an infant of one or two years of age. The mouth and neck of the uterus were not larger than a crow-quill in diameter, but perfectly defined : one of the ovaries was imperfect. The patient had, on a few occasions, observed an appearance resembling menstruation. (Obstet. Record, May 1848, 169.) The absence of a uterus, and the absence of the function of menstruation, do not necessarily prevent the development of strong sexual propensities, although there is of course incurable sterility. (See case in Assoc. Med. Jour. July 29, 1853, p. 672.)

Some of the physical causes of sterility in the female are removable by art. Thus, when the vagina is unnaturally closed, this condition may be often remedied by operation. An instance of this kind is related by Mr. Dumville (Medical Gazette, vol.

40. p. 1116), in which a female subsequently married and bore a child. It is a fact worthy of notice, that if the internal organs are in their normal condition, the slightest aperture will suffice for impregnation. Penetration is not necessary. Women have thus been known to conceive under circumstances which appeared quite adverse to the possibility of conception; and when they had arrived at the full time, it has been found necessary to make a free incision into the parts which resisted the passage of the child's head. A remarkable case of this kind, which occurred to Dr. Simmons, is quoted in the Lancet (June 19, 1847, p. 651), and there are many others of a similar nature on record. Sometimes the external passage is free, but the occlusion may be at the os uteri. This is a cause of sterility which, however, admits of remedy by operation. A case of this kind was successfully treated by my colleague Dr. Oldham (Med. Gaz. vol. 38. p. 919.)

An absence of the menstrual function (amenorrhœa) has been described as a cause of sterility; but several cases have been already mentioned, which show that females who have never menstruated, or in whom the discharge has appeared and has ceased for many years, and who are otherwise healthy and well formed, may become impregnated. When, however, the absence of menstruation depends on occlusion of the mouth of the uterus, or other physical causes of the like nature, there will of course be sterility. If, in other respects, the female is well formed, she cannot be regarded as in a necessarily incurable condition. Dr. Oldham has published two cases in which the females had each attained the age of forty-eight years without having menstruated. (Med. Times and Gaz. March 27, 1852, p. 311.) There was general good health, with a proper development of the sexual organs, in both. An inordinate periodical discharge (menorrhagia), depending on uterine disease, or disturbed and difficult menstruation (dysmenorrhœa), is a frequent cause of sterility. The deranged health which accompanies these morbid conditions may be, however, itself unfavourable to conception. Difficult menstruation frequently depends on stricture of the neck of the uterus. Sterility arising from this and other diseased states of the menstrual function admits of remedial treatment. Mr. Brown has also noticed that prolapsus ani, fissure of the rectum, and other diseases affecting this bowel, as well as the presence of worms therein, may be causes of temporary sterility. (Med. Times and Gaz. Feb. 21, 1857, p. 186.)

There is a popular notion that women during menstruation and lactation are sterile; but this is incorrect. (Henke, Zeitschrift, 1844, 263.) *Leucorrhœa*, or that morbid state of the uterus and vagina which accompanies it, is commonly set down as a cause of sterility; but it is well known that some females, who have for years suffered from leucorrhœal discharge, have conceived and borne children. M. Donné thinks that this fact is explicable on chemical principles. He has observed that the zoosperms on which fecundation depends, live and are active in the vaginal secretion on some occasions, while their movements are at other times speedily arrested. In the latter case, he has found the mucus strongly acid, and he considers that this may act noxiously, and destroy the zoosperms. The uterine mucus is alkaline, and in general the zoosperms are unaffected by it: in cases, however, where it was strongly alkaline, their motions were also destroyed. (Cours de Microscopie, 330.) Further observations are required before this theory can be admitted. The physiology of conception, as to the precise time and circumstances under which it occurs, is altogether a mystery (*ante*, p. 610). Well-organized and healthy women remain sometimes married for years without bearing children: when, without any apparent change of habit, they become impregnated, even after a barrenness of fifteen or twenty years. Any diseased condition of the system is unfavourable to impregnation, and *à fortiori* diseases affecting the uterus or ovaries. Of all these diseases, chronic endo-uteritis, or what may be called irritable uterus, is, in Mr. Whitehead's opinion, one of the most frequent causes of sterility. (On Abortion, 400.) This view is also supported by Dr. W. Cumming, of Edinburgh. His observations tend to show that a diseased state of the lining membrane of the uterus is a frequent cause of temporary sterility. It may be removed by proper treatment. (Lancet, May 12, 1855, p. 480.) Change of air and climate has in some instances alone sufficed to remove sterility, probably by relieving a diseased condition of the generative organs. It has been remarked, too, of males and females, that there has often been a return of procreative power after recovery from an attack of fever (*ante*, p. 668). On the whole, the physical and irremediable causes of sterility in the female are not so apparent as in the male, because in the former the generative apparatus is placed internally, and slight changes in its various parts, sufficient to produce permanent sterility, cannot be determined by an examination.

Legal relations of the subject. Divorce.—Sexual malformation, involving impotency or sterility, constitutes one of the *canonical* impediments to marriage, and if matrimony be contracted by a party labouring under such malformation, the contract is voidable. Canonists have reckoned fourteen impediments to matrimony, enumerated in the following quaint hexameters (Poynter's Doctrine, 84):—

> " Error, conditio, votum, cognatio, crimen,
> Cultûs disparitas, vis, ordo, ligamen, honestas,
> Si sis affinis, si forte coire nequibis,

> Si parochi et duplicis desit præsentia testis,
> Raptave sit mulier, parti nec reddita tutæ,
> Hæc facienda vetant connubia, facta retractant."

In the marriage contract there is implied a capability of consummation, and an incapacity in either party in this respect constitutes a ground for annulling the agreement. "Vir et mulier si se conjunxerint, si postea dixerit mulier de viro quod non possit coire cum eo, si potest (per verum indicium) probare quod verum sit, accipiat alium (Caus. 23). Quia matrimonium ordinatum fuit non solum ad evitandam fornicationem, sed etiam ad proles procreandas: si matrimonium (tale quale) fuerit, inter virum et mulierem de facto solemnizatum, qui omnino inhabiles sunt, *non propter ætatam*, sed propter aliquod naturale impedimentum ad proles suscitandas, utpote propter impotentiam et frigiditatem, maleficentiam, et similia, quæ ipso jure reddant hujusmodi matrimonium nullum. Hæc impedimenta naturalia aliquando contingunt tam in muliere quam in viro et pars gravata agere potest in causâ nullitatis matrimonii." (Oughton, tit. 193, sec. 17.) As to presumed incapacity from *age*, the law takes no cognizance of it. The Pappian law of the reign of Tiberius forbade women under fifty to marry men of sixty, and *vice versâ*, but it is now known that females are prolific beyond fifty, and males beyond sixty.

The impediment constituting impotency may arise either from malformation, from that which the law calls frigidity of constitution, or any physical cause of whatever nature which may render intercourse impossible. When the physical defect is not apparent and irremediable, a continued cohabitation of three years is required before a suit can be entertained (Ayliff's Parergon); but according to Oughton—"hæc triennalis expectatio non est necessaria ubi statim possit constare de impotentiâ coeundi." Suit for a sentence of nullity may be promoted by either party, and the medical proof required to found a sentence must be such as to satisfy the Court that the incapacity pleaded was in existence at the time of the marriage, and that it still remains without remedy. There should be no delay in instituting the suit, and there should be proof that the impediment was not known to the complaining party at the time of the contract. A longer delay in making the complaint is allowed to a female, without prejudicing her case, than to a male, by reason of the modesty of her sex. In a case which came before the Ecclesiastical Courts in 1845, a singular question arose whether, when there was a capacity of intercourse on the part of a female, with a certainty that from physical defect it could never be prolific, this was sufficient to entitle the husband to a divorce. The female was examined by Drs. Bird, Lever, and Cape: and they reported that the sexual organs were undeveloped, like those of girls who had not reached puberty, that the vagina was only three quarters of an inch in depth, and that there was no uterus. They stated that sexual intercourse might take place in an imperfect way; but that conception could not result. On a second examination, seven months afterwards, it was found that the vagina had become elongated, and had then a depth of two inches; but there were no medical means of improving its condition or of removing the defect. It was contended for the husband that the defect was natural and irremediable, and that he was entitled to a sentence of nullity of marriage. On the part of the wife, it was insisted that in order to entitle a party to this sentence, there must be an *utter impossibility* of sexual intercourse. The case, it was argued, was one of mere sterility, which was no ground for a sentence. Actual consummation had taken place. Dr. Lushington, in pronouncing judgment, said, that mere incapability of *conception* is not a sufficient ground whereon to found a decree of nullity. The only question is, whether a female is or is not capable of sexual intercourse: or, if at present incapacitated, whether that incapacity admits of removal. A power of sexual intercourse is necessary to constitute the marriage bond; and this intercourse must be ordinary and complete, not partial and imperfect; yet it would not be proper to say that every degree of imperfection would deprive it of its natural character. If it be so imperfect as to be scarcely natural, it is, legally speaking, no intercourse at all. As to conception, there is no doubt that the malformation is incurable. If there was a reasonable probability that the female could be made capable of natural coitus, the marriage could not be pronounced void: if she could not be made capable of more than an incipient, imperfect, and unnatural coitus, then it would be void. Dr. Cape stated that under present circumstances there could only be restricted and limited connection: it could not be called perfect and complete. The vagina might possibly become a little more elongated, but this would expose the female to danger. From these facts the marriage was pronounced null and void. (See American Journal of Med. Sci. Jan. 1848, 305.) Hence we may infer, that if the vagina had been of its natural length, notwithstanding the absence of the uterus and the impossibility of conception, a sentence of nullity would not have been pronounced. This is rather conflicting with the doctrine, that the main object of a marriage, valid in law, is *ad proles procreandas*.

The nature of the medical evidence required on these occasions will be best understood by the following extract from Oughton:—"Ad probandum defectus judex compellere potest virum ad exhibendum præsentiam suam et ad ostendendum in aliquo loco secreto (per judicem assignando) pudenda sua, seu illos corporis defectus quos mulier objicit (si ex inspectione corporis apparere possint), medicis et chirurgis peritis prius judicialiter in præsentiâ partis adversæ, de diligentur inspiciendo virum et de referendo in scriptis eorum judicium juratis. Et si medicorum et chirurgorum judicium sit quod morbus vel defectus viri fuerit insanabilis et incurabilis (tamen tenentur in relatione eorum judici ipsum morbum seu defectum specificare ne circumveniatur Ecclesia), et quod in eorum scientiâ, doctrinâ, experientiâ morbus aut defectus hujusmodi nullâ re aut arte medicâ curari possit, mulier obtinebit in causâ: hoc addito et allegato ex parte mulieris, quod ipsa sit juvenis et ad procreationem apta, et quod per *tres annos* insimul pernoctarunt, et quod, quamvis a marito cognosci cupiebat, ab eo tamen cognita non fuit nec cognosci potuit. Et si defectus non possunt directe per medicos et chirurgos juratos, judicari aut decerni; vel forsan dubia sit eorum relatio; allegetur ex parte mulieris, non solum quæ ultimo recitata sunt, sed etiam hoc addito:—*Quod sit virgo intacta nec a quoquam cognita.* Et ad hoc probandum judicialiter jurandæ sunt obstetrices ad inspiciendum mulierem, an vera sint hæc allegata. Et si judicio hujusmodi obstetricum, reperta fuerit virgo, saltem femina intacta nec a quoquam cognita; et si vir non possit aliquos defectus objicere contra uxorem, ob quos cognosci non possit; hæc dictarum mulierum relatio cum judicio medicorum et chirurgorum (quamvis dubio) unà cum cæteris prædictis indiciis (videlicet in eo quod mulier sit juvenis, et quod concubuit cum viro per triennium, ac quod ex aspectu apta et idonea videatur ad procreationem) sufficiunt ad divortium; seu potius ad pronunciandum *nullum ab initio* matrimonium fuisse inter hujusmodi personas; easque ab invicem, et ab omni vinculo et fœdere conjugali, liberas et immunes fuisse et esse. Et notu quod si defectus objiciantur contra mulierem probandi sunt isto modo per inspectionem et relationem."

A case came before the Vice-Chancellor's Court, in February 1845 (*Wilson* v. *Wilson*), in which the female produced medical certificates to prove that she was "virgo intacta!" In drawing up such a certificate, a medical reporter should bear in mind that females have become pregnant with what is commonly regarded as the chief sign of virginity *intact.* Indeed, the division of the hymen has been often rendered necessary for the delivery of a child. Negative evidence of non-consummation from the physical condition of the female, is therefore of much less value, *cæteris paribus*, than the affirmative evidence from the existence of a physical defect in the male.

When the defect is not apparent on an examination, the case is attended with considerable difficulty. Divorce has, however, been granted even in these cases, when the husband has acknowledged his incapacity, and when, notwithstanding cohabitation for some years, this admission has been confirmed by an examination of the wife. Even when the male organs do not appear well developed, and sexual desire is absent, great caution is required in drawing up a report. In the case of *Bury*, the marriage was dissolved on the ground of impotency; but this man afterwards married, and had issue,—a fact which proved that "ecclesia circumveniatur." This gave rise to a difficult question: for it was contended, if the divorce was null, the second marriage was unlawful and the issue illegitimate. It was decided, however, that the second marriage was only voidable; and that, until dissolved, it remained a lawful marriage, and the children during coverture were legitimate. In investigating a case of this kind, when there is no apparent physical defect or malformation, it is necessary to examine the bodily state of the individual, whether he is effeminate, or has about him any or all of the usual marks which attend a virile state. In the latter case the impotency may be temporary; and it would be decidedly unsafe to pronounce an opinion adverse to the existence of procreative power.

From these considerations, it will be perceived that, in order to justify a suit of divorce, on the ground of impotency or sterility, the impediment to intercourse or procreation must be apparent and irremediable; it must also have existed before the marriage of the parties, and have been entirely unknown to the person suing for the divorce: if it has supervened after the marriage, this is no ground for a suit. The nature of the impediment is to be determined by private medical opinions or affidavits, based on an examination of *both* parties. There is one remarkable circumstance with respect to these cases; namely, that in nearly all of them, the suit is by the female against the male; although there is no reason whatever to suppose that impotency and sexual malformation are more common in males, than sterility in females. We rarely hear of a man instituting a suit of divorce on the ground of sterility (incapacity) in the wife; it is, I believe, in most instances, that the wife promotes the suit on the ground of impotency in the husband. The difficulty of establishing incapacity in the female, and the facility of proving impotency from physical causes in the male, may probably account for the difference. Suits of this kind are sometimes instituted many months and years after the union of the parties; but it is pretty certain that the desire for separation in these cases often depends on some other cause, which the law would not recognize as sufficient of itself, while it would admit the plea of impotency. The French law very judiciously applies the principle of condonation to such cases, so that no suit for nullity of marriage can be entertained, if cohabitation has continued for six months after the discovery of the personal defect. This appears to me more consistent with justice than our own law; but practically these suits, after protracted cohabitation, are always regarded with great suspicion. One of the latest of these cases (*Castleden* v. *Castleden*) came before the Divorce Court in Feb. 1860. The wife required a declaration of nullity of marriage, on the ground of her husband's impotency. The parties were married in 1834 and cohabited until 1838. Of the three judges, two were adverse to the petitioner's claim, and this was rejected.

RAPE.

CHAPTER 58.

NATURE OF THE CRIME—SOURCES OF MEDICAL EVIDENCE—RAPE ON INFANTS AND CHILDREN—LEGAL COMPLETION—PROOFS OF PENETRATION—MARKS OF VIOLENCE—RUPTURE AND LACERATION—PURULENT DISCHARGES FROM THE VAGINA—EVIDENCE FROM GONORRHŒA AND SYPHILIS. RAPE ON YOUNG FEMALES AFTER PUBERTY. DEFLORATION—SIGNS OF VIRGINITY—PROOFS OF INTERCOURSE. RAPE ON THE MARRIED—RAPE UNDER THE INFLUENCE OF NARCOTICS—ON IDIOTS. MICROSCOPICAL EVIDENCE. LEGAL RELATIONS. SODOMY.

Nature of the crime. Sources of medical evidence.—Rape is defined in law to be the carnal knowledge of a woman by force, and against her will. In ancient times it was punished by castration,—a punishment which, according to Dr. Griffiths, is still retained in Virginia and Missouri, when the crime is perpetrated by a coloured man on a white woman, but not *vice versâ*. The Roman law, on which our ancient law was founded, was to this effect—Rapta raptoris aut mortem aut indotatas nuptias optet, upon which there arose what was thought a doubtful case: "Unâ nocte quidam duas rapuit: altera mortem optat, altera, nuptias!" For a long period it was punished as a capital crime in this country, but transportation for life was substituted for this punishment by 4 and 5 Vict. c. lvi. s. 3. Since this change was made in the law, it has been alleged, on good authority, that the crime has undergone a considerable increase. On the average of four years, rapes increased 57 per cent. (Law Times, Jan. 4, 1845): and it was stated officially in Parliament, in 1847-8, that the increase had actually amounted to 90 per cent. since the abolition of capital punishment! Medical evidence is occasionally required to support a charge of rape; but it is seldom more than corroborative. the facts are in general sufficiently apparent from the statement of the prosecutrix. There is, however, one case in which medical evidence is of some importance; namely, when a false accusation is made. In some instances, as in respect to rape on infants and children, the charge may be founded on mistake; but in others there is little doubt that it is often wilfully and designedly made for motives into which it is here unnecessary to inquire. The late Professor Amos remarked, that for one real rape tried on the Circuits, there were on the average twelve pretended cases! In some few instances these false charges are set aside by medical evidence;—but perhaps in the majority they are developed by inconsistencies in the statement of the prosecutrix herself. I am informed that in Scotland, where there is a public prosecutor and a careful preliminary inquiry, false charges of rape are exceedingly rare. The *consent* of the female does not excuse or alter the nature of the crime when she is under ten years of age, since consent at this period of life is invalid; and the carnal knowledge of such a female is rape in law. Even the solicitation of the child does not excuse the act.

The duty of a medical witness on these occasions is very simple; and perhaps this will be best understood by considering the subject in relation to females at different ages. On being called to examine a person on whom a rape is alleged to have been committed, the first circumstance which a practitioner should notice, is the precise *time* at which he is summoned,—taking an early opportunity of comparing his watch with some neighbouring clock. This may appear a very trivial matter, and one wholly irrelevant to the duties of a medical practitioner; but it is to be observed, that the time at which a surgeon is required to examine a prosecutrix may form a material part of the subsequent inquiry. It will be highly important to the defence of a person accused, if it can be proved that the female did not take the earliest opportunity to complain; and it may be also the means of defeating an alibi falsely set up by an accused person in his defence.

Medical evidence of rape may be derived from four sources:—1. Marks of violence about the genitals. 2. Marks of violence on the person of the prosecutrix or prisoner. 3. The presence of stains of the spermatic fluid, or of blood, on the clothes of the prosecutrix or prisoner. 4. The existence of gonorrhœa or syphilis in one or both. This evidence will vary according to the following circumstances:—

ON INFANTS AND CHILDREN.

The sexual organs should in these cases present traces of injury if the crime has been completed, and there has been *any resistance on the part of the child:* for it is impossible to conceive that forcible intercourse should take place without the production of ecchymosis, the effusion of blood, or a laceration of the pudendum. It has been propounded as a serious question, whether a rape *can* be perpetrated on a child of this age by an adult man; and medical witnesses at trials have been found to adopt diametrically opposite views on this point. For the *legal* establishment of the crime, proof of penetration only is demanded; and it would appear from an old decision in the case of *Rex* v. *Russen*, that a degree of penetration so slight as not to injure the hymen would be sufficient to complete the crime. In the case alluded to, the hymen of the child was proved to be entire, and under the direction of the judge, the prisoner was convicted and executed. This trial took place in 1777; but Gurney, B., subsequently held that there must be a sufficient penetration of the male organ to rupture the hymen; and, unless this membrane was found ruptured, the crime would not be complete in law. (*Rex* v. *Gammon*, Archbold, Crim. Plea. 407.) This decision was afterwards over-ruled by the judges, in a case reserved for their consideration by Coleridge, J., and reported in 9 Carrington and Payne. (See also *Reg.* v. *Lines*, 1 Carrington and Kirwan's Reports.) It is now, therefore, an admitted principle, that a sufficient degree of penetration to constitute rape in law, may take place without necessarily rupturing the hymen; but there must be medical evidence to show that, in a special case, there was actual penetration:—the degree of penetration being quite immaterial. It is true that there could not be a complete introduction of the adult male organ into the vagina of a child without a rupture or laceration of the soft parts; but the absence of such marks of violence would not justify a medical witness in denying the perpetration of the crime, since the law does not require proof either of a complete or of a violent introduction. Penetration to the vulva is sufficient.

Proofs of penetration.—In a case brought before a magistrate a few years since, the evidence left no doubt that the crime had been committed on the person of a girl about ten years old. The surgeon stated that there were considerable marks of violence about the pudendum, but completion (*i. e.* penetration) was, in his opinion, physically impossible on a child under ten years of age. Upon this evidence the charge of felony was abandoned. In the following case the child was older, but the facts bear immediately upon the question which we are here discussing. It was tried at the Central Criminal Court, March 1843; and the particulars were communicated to the profession by Mr. Adams. (Lancet, March 25, 1843.) A man was charged with a rape upon his own child, aged fourteen. Mr. Adams examined the child about two days after the alleged perpetration of the crime; and he found no injury about the vulva or adjacent parts, and the hymen was unruptured. He gave a positive opinion at the trial that no rape had been committed. Two other medical witnesses, men of experience and integrity, stated their belief that the crime had been perpetrated. It appears that they had examined the child soon after the alleged offence, and a day or two before Mr. Adams. The prisoner was acquitted of the rape, but found guilty of the assault. The absence of any marks of injury about the vulva, so short a time after the alleged criminal act, and the fact of the hymen being unruptured, in some measure justified the opinion of Mr. Adams, that there was no medical proof of a rape having been committed: at the same time he candidly restricted his opinion, by saying, that if by rape we are to understand penetration to the vulva, then was it effected; but there was no evidence to show vaginal penetration: on the contrary, the unruptured state of the hymen in an alleged forcible intercourse was against this view. The only remark which this case requires is, that the statute law says nothing about the rupture of the hymen as a necessary part of the evidence: it merely requires proof of penetration. This may occur, and the hymen remain intact. The distinction here drawn by the witness has no real existence. From the decisions of our judges, vulval penetration, whether with or without violence, is as much a rape as vaginal penetration.

In Scotland this question came formally before the judges in the case of *Macrae.* (High Court of Justiciary, 1841.) It was insisted by the prisoner's counsel, that there should be proof of full and complete penetration; and there was no sufficient evidence to show that penetration had taken place into the canal of the vagina beyond the vulva. Lord Meadowbank charged the jury to the effect, that the evidence of the prisoner's guilt was complete; the scientific and anatomical distinctions as to where the vagina commenced, were worthless in a charge of rape; and that by the law of Scotland it was enough if the woman's body were entered. In a case like this, where there was no evidence of emission, and the girl was young, he did not consider it necessary to show to what extent penetration of the parts had taken place,—or to prove that it had gone past the hymen, into what was anatomically called the hymen, or even so far only as to touch the hymen. The prisoner was convicted. (Cormack's Edin. Jour. January, 1846, p 48.) See on this question a paper by Dr. Easton, Glasgow Med. Journal, July 1859, 129.

Marks of violence.—When, as in the case above related, there are no marks of violence or physical injury about the pudendum of a child, whether because none originally existed, or they had existed and disappeared in the course of time, a medical witness must leave the proof of rape to others. He can only answer questions of possibility or probability, according to the special facts proved. It is, however, in all cases his duty to be guarded in giving an opinion that a rape has been perpetrated, when there is a total absence of marks of violence on the genitals. It is true that rape in a legal sense may be perpetrated without necessarily producing such marks on a child: but then the proof of the crime will not depend on *medical evidence* only. The absence of marks of violence on the genitals, when an early examination has been made, furnishes a strong presumption that rape has not been committed on these young persons. It is obvious that a false charge might be easily made and sustained, if medical opinions were hastily given on the statements of a mother and child, when there was no physical appearance to corroborate the accusation.

On the other hand, if marks of mechanical violence are present, they must not always be hastily assumed as furnishing proof of rape; for cases are recorded in which such injuries have been purposely produced on young children, as a foundation for false charges against individuals with a view of extorting money. The proof or disproof of facts of this kind must rest more upon general than on medical evidence, unless the injuries obviously indicate the use of some weapon or instrument. It should be remembered, that the hymen is not always present in young children:—it may be, according to some, congenitally deficient, or, what is more probable, it may have been destroyed by ulceration or suppurative inflammation of the parts,—a disease to which female infants of a scrofulous habit are very subject. The mere absence of this membrane, therefore, can afford no proof of the perpetration of the crime, unless we find traces of its having been recently torn by violence.

Other and more important deductions may, however, be drawn from the presence of severe injuries to the genitals, *i. e.* of rupture, or laceration of the vagina or perinæum. It is difficult to obtain accurate medical reports of these cases as they occur in England: but it is quite clear that the male organ may produce much physical injury whether the child does or does not resist the attempt. Dr. Chevers, in referring to Indian experience, says that, in a large proportion of rapes on children, it was very clearly proved that rather severe injury had been received. In the Nizamut Adawlut Reports, 1853-5, there are several instances recorded, in which the vagina was lacerated. Out of 66 trials for rape there were 52 convictions: and in one half of these cases the females were under the age of *twelve*. In one case of a girl, æt. twelve, there was a rupture of the lower part of the vagina to the extent of half an inch. In another, a child of six, but apparently much younger, had suffered, as a result of rape, from rupture of the hymen and laceration of the perinæum and vagina. In one instance the violence proved fatal, but the medical particulars were not given (Med. Jur. for India, p. 468.) I have already observed that injuries have been sometimes intentionally produced on the genitals of infants and children by mechanical means,—with a view of extorting money in laying false charges of rape. Dr. Chevers, from whose work I have quoted the above facts, states, on the authority of a missionary well acquainted with the habits of the natives of Calcutta, that mechanical means are commonly employed even by the parents of immature girls, to render them *aptæ* viris, especially by the use of the fruit of the plantain. In one instance, a man was convicted of rape who, according to the evidence, had previously used a small stick—*ad deobstruendam viam.* This led to effusion of blood, but no permanent injury.

In April 1840, Dr. Brady communicated to the Dublin Association of Physicians, a case of alleged rape on a female infant only eleven months old, in which the violence done to the genitals proved fatal. During the march of a regiment to Templemore, the prisoner *Hume*, a soldier, who was with the sick car, took the child from its mother (Mary Hall) to carry it some way for her. The child was quite well when he took it: he walked on quickly and was out of the mother's sight in half an hour. When she came up, he had the child standing on the grass facing him, and he was bent over it: with one hand he held the child's petticoats up, and his other hand was covered with blood. He told the mother that the child was ill and passing blood. The mother rolled it in her shawl, and carried it until she reached Templemore when she went to an apothecary; but no examination was then made, and it was not until the next morning that in washing the child the marks of violence were seen. This was the substance of the mother's evidence, which was uncontradicted at the trial. A surgeon examined the child twenty hours after the alleged outrage. It was then in a state of complete collapse, and it died in a few hours. On examination, all the external parts of generation were found in a torn state, and violently inflamed; the perinæum was torn nearly quite through: the nymphæ, and the mucus lining of the labia, and clitoris were likewise lacerated, so that the whole presented the appearance of a large lacerated wound in a high state of inflammation. After death, besides the above-mentioned appearances, the vagina was found greatly dilated and torn from its attachment to the neck of the uterus posteriorly, making a large opening into the cavity of the abdomen, in which a quantity of bloody serum was effused. (Medical Gazette, vol. 26. p. 160.) Mr. Wilde of Dublin, on recently making inquiry into the particulars of this case, has ascertained that there was no proof of the perpetration of rape. The severe injuries to the genital organs which led to death were produced, it is alleged, by the fingers—the man being at the time partially intoxicated.

(Dub. Quart. Journ. of Medical Science, Feb. 1859.) This can scarcely be regarded as exculpatory: for if a female child is destroyed by violence to the genital organs, it can create no difference on a charge of manslaughter whether the injuries were produced by the fingers or by the male organ.

In January 1858, a girl seven years old was brought into Guy's Hospital, owing to injuries resulting from a perpetration of rape by a boy under seventeen years of age. About half an hour had elapsed; she was then examined by Mr. Hicks, the house surgeon, and he found that there was complete destruction of the hymen, with a laceration of about one eighth of an inch extending into the perinæum. There had been profuse bleeding, as the clothes were saturated with blood. There was then no complaint of pain, and there were no scratches or marks of violence on any part of the body. There was no discharge of a purulent kind. The child was of a scrofulous habit: but she was not suffering from vaginitis, and appeared in other respects perfectly healthy. I saw the girl with Mr. Hicks about forty-eight hours after the occurrence: the bleeding had then ceased, and the extent of the lacerations was very perceptible. There was no discharge of any kind from the vagina, and no inflamed or swollen condition of the parts. The boy was examined by Mr. Hicks about an hour after the perpetration of the rape, and although he had been under strict custody and had had no opportunity of changing his clothes, there was no blood found about his private parts, or on his clothing. It is probable, as the boy was interrupted in the act by the screaming of the girl, that he suddenly withdrew after having caused the laceration, and that the bleeding was an after effect, as a result of oozing from the small vessels. This is an important fact, because had not the circumstances been known, the absence of blood on his person might have been construed into a strong proof of innocence. Dr. Sawyer met with a case in which a rape was committed on a girl, æt. 5. There was a bruised and swollen state of the genitals. The hymen was not ruptured, and there was no laceration of parts. In spite of this there had been a large amount of blood lost. This bleeding, he considers, took place from the hymen, which was in a highly congested state. The man who had perpetrated the crime was examined soon afterwards, but no appearance of blood was found on his organs. There were a few stains only on the front of his clothing. (New Orleans Med. Gaz. 1858, p. 282.)

Sometimes, owing to the violence used, the parts are lacerated: and inflammation, followed by sloughing or mortification, may set in and destroy life, especially in children of an unhealthy habit. Care should be taken that the symptoms of a malignant form of disease (noma) to which female children are sometimes subject, are not mistaken for the effects of criminal violence. The case of *Amos Greenwood* (Liverpool Winter Assizes, 1857) is of some interest in this respect. The prisoner was convicted of the manslaughter of a female child under ten years of age, as a result of injuries produced by a criminal assault. The main facts against the prisoner were considered by the Court and Jury to be clearly proved : he was convicted and sentenced to penal servitude for life. The propriety of this conviction has been strongly questioned by Mr. Wilde in a paper published in the Dublin Quarterly Journal for February 1859. It would be impossible in this place to give an analysis of the conflicting statements and counterstatements which have been made respecting Greenwood's case ; but there is no reason to doubt that the prisoner was accessory to the death of the child. A distinguished member of the Northern circuit, who took no part in the case, but was present and heard the whole of the evidence, has informed me that it was satisfactorily proved that violence had been done to the genital organs, and in the general opinion of the bar the man was rightly convicted. The reader will find the evidence fully discussed in the Med. Times and Gazette for 1859, April 9, p. 361 ; April 23, p. 417 ; April 30, p. 442 ; May 21, p. 518 ; May 28, p. 544 ; June 18, p. 638 ; and July 2, p. 21.

Mr. Colles has reported a case in which a rape was committed by an adult on a child eight years old, and it terminated fatally from peritonitis, as a result of the violence, six days after the assault. The child stated that the accused had had forcible connection with her, causing much pain and loss of blood. There were no marks of violence (bruises?) externally, but the orifice of the vagina was lacerated in its entire circumference, and the perinæum was nearly torn through. It was found, on inspection, that the orifice, as well as the whole of the vagina, was in a state of gangrene, and its posterior wall had been torn through at its line of junction with the uterus to the extent of an inch. There was no ulceration. The labia and clitoris had not undergone any change. (Med. Times and Gaz. June 2, 1860, p. 560.) The prisoner in this case confessed his guilt. A case was communicated by Dr. M'Kinlay to the Glasgow Medical Journal (July 1859, p. 140), which proves that extensive injuries may be produced on a child by the act of violation. The girl in this instance was about six years of age, and very intelligent. From her description of the assault, it appears that she fainted, probably owing to the severity of the pain. When examined, it was found that the vagina was lacerated in various directions. One laceration extended from the lower part downwards, dividing the recto-vaginal septum, and perinæum down to the verge of the anus. There was a lacerated opening in the coats of the rectum. The orifice of the vagina was lacerated upwards as well as laterally. The parts were raw, swollen, and very tender. When first seen, there was blood on the limbs and clothes of the child. The child recovered from these serious injuries in about two months. In reference to the case of Amos Greenwood (*suprà*), it was a question raised in favour of the prisoner, whether rupture of the perinæum could or could not be effected in rape on a girl. Some eminent members of the profession appear to have doubted the possibility of rupture being produced under these circumstances. (See Mr. Wilde's paper, Dub. Med. Journal, February 1859). But the facts here recorded show that this opinion is erroneous.

In a case which occurred to Dr. Bullen, a girl æt. seventeen, was violated by several men in succession: she then became insensible and was unable to state how often the act had been perpetrated. When examined the next day, the genitals were bloody, inflamed, and painful, the hymen was ruptured, the fourchette torn, and the labia and perinæum presented a dusky inflammation. In spite of treatment, ulceration followed, and the clitoris, nymphæ, perinæum, labia, and mons veneris sloughed away, leaving the pubis exposed. After a long illness the ulcer healed, and she left the infirmary. At no period were there symptoms of syphilis. Such a state of parts,—obviously a result of violence, might have been erroneously ascribed to *noma* or malignant ulceration or mortification of the genitals, as it is observed in some eruptive fevers. (Dub. Med. Press, March 1840; Beck's Med. Jur. vol. 1. p. 160.)

Purulent discharges from the vagina.—Vaginitis. Infantile Leucorrhœa.—The existence of a purulent discharge from the vagina, as a result of vaginitis or inflammation of the vagina, has been erroneously adduced as a sign of rape in these young subjects. The parents, or other ignorant persons, who examine the child, often look upon this as a positive proof of impure intercourse: and perhaps lay a charge against an innocent person, who may have been observed to take particular notice of the child. Some cases are reported, by which it would appear that individuals have thus narrowly escaped conviction for a crime which had really not been perpetrated. Dr. Percival, in his Medical Ethics (3rd ed. 1849, p. 117), has related a case which has been the subject of frequent quotation and comment in reference to false charges of rape. A girl æt. 4 was admitted into the Manchester Infirmary in February 1791, on account of a mortification of the female organs and general depression of strength. She had been in bed with a boy fourteen years old, and there was reason to suspect that he had taken criminal liberties with her. The mortification increased and the child died. The boy was tried at the Lancaster Assizes, but was acquitted on sufficient evidence that several instances of a similar disease had appeared near the same period of time, in which there was no possibility of injury or guilt. In one of these cases there was typhus fever with a mortification of the pudenda. There was no cause discoverable on inspection. The lumbar glands were of a dark colour; but all the viscera were sound. This case, with the whole of Mr. Kinder Wood's paper on the subject, has been republished by Mr. Kesteven. (Med. Times and Gaz. 1859, April 23rd and 30th.)

A purulent discharge with aphthous ulceration is occasionally a result of vaginitis (inflammation of the vagina) in young children. It may arise from dentition, or local causes of irritation—as worms or uncleanly habits, and is observed especially in children of a scrofulous habit. It is frequently met with in girls up to six or seven years of age: and children thus affected have been tutored to lay imputations against innocent persons, for the purpose of extorting money. This state may commonly be distinguished from the effects of violence, either by the hymen being entire — or by the non-dilatation or laceration of the vagina or perinæum—by the red and inflammatory condition of the mucous membrane,—and the abundance of the purulent discharge, which is commonly much greater than that which takes place as a mere result of violence. Capuron mentions two cases, in which charges of rape on children were falsely made against innocent persons, on account of the existence of a purulent discharge, the nature of which had been mistaken. (Méd. Lég. des Accouchements, 41.)

This subject long since attracted the attention of Mr. Kinder Wood, Sir Astley Cooper, Mr. Lawrence, and other medical men: but there is still much popular ignorance in reference to it, and false charges of rape on children are not unfrequently made. Mr. Kesteven has reported a case in which a discharge from the vagina of a child nine years of age, was considered by the parents to indicate that intercourse had been had with her. There was no mark of contusion or violence on or about the pudendum or in the vagina, and the case was very properly pronounced to be one of vaginitis. (Med. Gaz. vol. 47. p. 372.) A similar case was referred to me in which a soldier was supposed to have infected a child: but an investigation showed that it was a purulent discharge depending on inflammation of the vagina. In another, which was the subject of a trial at the Somerset Autumn Assizes, 1857, *Reg.* v. *Hodges*, there is reason to believe that the accused was improperly convicted of a criminal assault on a child when the appearances were really due to the existence of vaginitis from natural causes. (See Report of the trial by Dr. J. Wybrants, of Shepton Mallet, 1861; also a letter by Mr. Hudson, Med. Times and Gaz. April 13, 1861, p. 403.) Charges of rape are sometimes rashly made in these cases, either in the absence of, or in actual defiance of, a medical opinion. Mr. Hamilton has reported an instance of this kind (Dub. Med. Press, May 4, 1853, p. 276), in a child æt. 7. There was an inflammatory state of the vagina, and a yellowish discharge issued from it; but there was no sign of rupture, contusion, or any mark of violence. The medical opinion was to the effect that there was nothing to show that any violence had been used to the child, or that she had been infected with the venereal disease. Nevertheless, the accused was placed on his trial; but the evidence of the child broke down, and the man was acquitted. In the same paper, Mr. Hamilton relates a case in which syphilis was communicated to a girl æt. 6 by a boy aged 19. In this case the accused was found to have numerous chancres around the orifice of the prepuce, and on examining the little girl, there were chancrous excoriations on the inside of the labia. Other syphilitic symptoms manifested themselves. The prisoner was convicted.

The subject of infantile leucorrhœa has been fully investigated by Mr. Wilde, of Dublin (Medico-legal Observations, &c. 1853). This gentleman has collected numerous cases illustrating in a remarkable manner the great danger to which innocent persons are exposed by reason of false charges of rape on children. Two of these are especially noticed in his essay. A charge was raised against a respectable man, that he had had intercourse with, and produced disease in, two children. The day and hour were circumstantially given, extorted as it appears from the children by the parent, and the man was put upon his trial. The appearances were such as are usual in these cases,—a purulent discharge from the vagina with some excoriation, but no bruise, laceration, or mark of violence on the pudendum. There had not been any penetration of the vagina. The charge against the prisoner, although unsupported by any affirmative circumstances, received some strength from the admission made by one medical witness for the prosecution, namely, that the appearances *might* have been the result of violence,—and that the discharge *might* have been produced by friction with the member of a healthy man. (Wilde, op. cit. p. 14.) It was proved that the prisoner was not affected either with gonorrhœa or syphilis. Drs. Geoghegan, Churchill, and other medical witnesses of repute, gave testimony to the effect that the child was labouring under an ordinary form of disease, and that there was no medical indication that it had been subjected to any kind of violence. This testimony was not considered by the Court to furnish a complete answer to the charge, since it was inferred that the appearances on the child *might* have been caused by the accused, without any marks of violence being left on the pudendum. So strong was this feeling, that, had the case rested here, it is probable the accused would have been convicted upon the unsupported statement of the child. An alibi was, however, clearly proved, and the man was acquitted. In this case, it will be perceived it was alleged that a man who laboured under no disease had caused a purulent discharge in a child! At the same time, it was admitted that the pudendum had sustained no violence whatever. Medically speaking there appears to have been not the slightest pretence for charging the accused with the perpetration of rape. The appearances might have been and might *not* have been caused in the manner suggested. Under such loose medical evidence as this no person is safe. An acquittal from an unfounded charge must depend upon the person accused being able to prove a distinct alibi, *i. e.* he must prove his innocence. The statement of the child may be simple and artlessly made. At this tender age, a girl may be easily induced, by the fear of punishment and by the aid of leading questions put by a parent, to admit that some one had committed an assault upon her. The statement once made may be persevered in, and its inconsistency may not always be brought out by a cross-examination.

If the child is really labouring under *syphilis* or *gonorrhœa*, this is, *cæteris paribus*, evidence of impure intercourse, either with the ravisher or some other person; but we should be well assured, before giving an opinion, that the discharge is really of a gonorrhœal, and not simply of a common inflammatory, character. The party accused, as in the case just related, might be at the time free from that disease, or, if labouring under it, then we should expect that the discharge had suddenly made its appearance in the child with its usual severe symptoms, at a certain interval of time after the presumed intercourse; *i. e.* from the third to the eighth day. When these conditions do not exist, it is extremely difficult to form a medical opinion on the subject, since there are no certain means, by the microscope or otherwise, of distinguishing common purulent discharges from those which are gonorrhœal. Under these circumstances, if the charge be well founded, proof can only be derived from non-medical sources. A case occurred to M. Biessy, in which a mere mucous discharge in a girl was pronounced to be syphilitic, and the party who was falsely accused of rape narrowly escaped conviction. (Briand, Man. Complet de Méd. Lég. 1846, 81.) We should further distinctly satisfy ourselves that gonorrhœa in a child, if it exist, could not have arisen from infection by any accident irrespective of intercourse. This limitation is rendered necessary by the publication of a report of two cases by Dr. W. B. Ryan (Med. Gaz. vol. 47, p. 744), in which two sisters, one of one year, and the other of four years of age, received the infection by reason of being washed in a vessel with a sponge used by a young woman affected with profuse gonorrhœal discharge. Dr. Ryan clearly traced the origin of the discharge to this unexpected accident. Had an accusation of rape been made against a man labouring under gonorrhœa, it is not at all improbable that this condition of the children, resulting from an unsuspected accident, would have been taken as an unanswerable proof of his guilt. Cases of this kind, thus accurately observed, convey an important caution to medical witnesses: *i. e.* that they should not infer criminal intercourse merely from the existence of a gonorrhœal discharge, in the absence of marks of violence to the genitals or other strong corroborative proofs.

As a summary of these remarks with respect to purulent discharges, we may observe, that they should never be admitted as furnishing corroborative evidence of rape, except,—1, when the accused party is labouring under gonorrhœal discharge;—2, when the date of its appearance in the child is from the third to the eighth day after the alleged intercourse;—3, when it has been satisfactorily established that the child had not, previously to the assault, any such discharge. It may be said, however, that all these conditions may exist, and yet the accused be innocent; for a child may, either through mistake or design, accuse an innocent person. This, however, removes the case entirely from the hands of a medical jurist. (The reader will find much useful information on this subject in a paper by Dr. Penard, Ann. d'Hyg. 1860, vol. 2. pp. 130, 345.)

In the *Queen* v. *Mosely* (Cent. Crim. Court, Sept. 1843), the prosecutrix, a child between twelve and thirteen years of age, charged the defendant with having committed a rape upon her, alleging that she had made all the resistance in her power. Dr. Merriman stated that he examined the prosecutrix two or three days after the alleged offence was committed, but could not give any decided opinion upon the case, although there was every appearance of violence having been used. Another medical witness stated that the prosecutrix had been under his care for the last eight or nine days for a disease (gonorrhœa) with which, in his opinion, she had been infected for a considerable time; and a third proved that the prisoner was not infected with this disease. Dr. Merriman, however, is reported to have said that the prosecutrix was not labouring under the disease when he examined her. It is difficult to explain how this discrepancy on a matter of fact of some importance could have arisen. The jury acquitted the prisoner, probably not trusting to the statement made by the prosecutrix. In another case, *Reg.* v. *M'Donough* (Cent. Crim. Court, Oct. 1843), Mr. French and Mr. Tucker deposed that the gonorrhœa under which the prosecutrix (æt. 15) laboured had probably not existed longer than a week, it might have been of longer standing, but it certainly could not have existed for six weeks, the date at which it was alleged that the rape was perpetrated by the prisoner, and the disease communicated. Upon this evidence the prisoner was acquitted.

The following case was tried at the St. Louis' Criminal Court. A man named *M'Comas* was charged with an attempt to violate a child æt. 9. The evidence against the prisoner was chiefly based on an extorted admission from the prosecutrix, and on the discovery on her clothes of certain stains supposed to have been produced by seminal fluid. The mother examined the genitals, and found them inflamed and discharging matter, although several weeks had elapsed since the alleged attempt. A medical practitioner was called to the girl; he found the nymphæ and orifice in a state of inflammation, which might have arisen from some morbid cause; but he was unable to give any positive opinion respecting the nature of the discharge. About eight days after this, the girl was examined by Dr. Stephens: the parts were still much inflamed, and discharging muco-purulent matter. The hymen was uninjured. The defence of the prisoner was, that he was not guilty of the assault, and that he was not labouring under gonorrhœa at the time of the alleged attempt. He was convicted and sentenced to three years' imprisonment. (British American Journal, May 1848, p. 19.) It is not improbable that this was a case of vaginal catarrh mistaken for gonorrhœa; for, as it has been already stated, there are no certain means of distinguishing the two kinds of discharges. The jury, however, appear to have put great faith in the testimony of the prosecutrix. The case was therefore decided by moral circumstances, and not by medical evidence. The existence of an unruptured hymen merely proved that there had not been a violent attempt at carnal intercourse.

With respect to marks of violence on the *body* of a child, these are seldom met with, because no resistance is commonly made by mere children (see case, *ante*, p. 686). Bruises or contusions may occasionally be seen on the lower extremities.

ON YOUNG FEMALES AFTER PUBERTY.

When the crime is committed on a female from the age of ten to twelve years, the facts are much the same as those already referred to with respect to children below the age of ten years. There is, however, some difference in the legal complexion of the offence. If carnal intercourse be had with the consent of a female between the ages of ten and twelve years, the offender is guilty of a misdemeanour only. Above the age of twelve years, the consent of the female does away with any imputation of legal offence. Females who have passed this age are considered to be capable of offering some resistance to the perpetration of the crime; and therefore, in a true charge, we should expect to find not only marks of violence about the pudendum, but also injuries of greater or less extent about the body and limbs. It is probable that in these cases, if the charge were well founded, the hymen would be ruptured, as the intercourse is always presumed to be violent; but there might be some degree of penetration without this being a necessary result, especially if the membrane were small, or placed far up. At any rate a young female at this age may sustain all the injury, morally and physically, which the perpetration of the crime can possibly bring down upon her, whatever may have been the degree of penetration; and for this reason, it is very properly laid down in our law, that the crime consists in the mere proof of penetration. The fact, however, is generally clearly made out by the statement of the female. With respect to *marks of violence* on the person, the exact form, position, and extent of these should be noticed; because a false accusation of rape may be sometimes detected by the violence being in a situation in which it was not probable that the ravisher would have produced it. When bruises are found, the presence or absence of the usual zones of colour may occasionally throw light upon the time at which the alleged assault was committed. As these marks of violence on the person are not likely to have been produced with the concurrence of the female, they are considered to furnish some proof of the intercourse having been against her will. But the physical appearances of rape about the pudendum may be found, whether the connection has been voluntary or involuntary. Thus rupture of the hymen, laceration of the vagina with effusion of coagula of blood, swelling and inflammation of the vulva, and stains of blood upon the person, dress, or furniture may be met with in both cases. In making an examination, the greatest care should be taken by the practitioner to fix at the time of examination a probable date for the marks of injury to the genitals or other parts of the body, as it is by the aid of such observations that the truth or falsity of a charge may be sometimes clearly established.

Unmarried females of the age here supposed, are liable to *muco-purulent discharges* from the vagina, as a result of which the hymen may be destroyed. This kind of discharge arises from inflammation of the vagina (vaginitis), and it has been observed to follow an attack of scarlatina. When it exists, its real cause requires the closest scrutiny. (See remarks by Dr. Barnes, Med. Gaz. vol. 46, p. 65.) At a more advanced age, young females are frequently subject to leucorrhœa. These cases are not likely to be mistaken for gonorrhœa; as here the female has it in her power to give some account of the circumstances, from which a medical opinion may be easily formed.

Defloration. Signs of virginity.—It will be necessary to say a few words respecting the *signs of virginity*,—a subject upon which, in some medico-legal works, a great amount of poetical discussion appears to me to have been wasted. Independently of cases of rape, this question may occasionally assume a practical bearing in relation to the signs of defloration. In civil cases a medical witness may be asked whether a particular female has ever had intercourse or not. Proof of this fact may be necessary in order to confirm or rebut statements made in evidence. The question may be, not whether a female has had a child or not, for this would resolve itself into a proof whether delivery had or had not taken place:—it may be limited to the probability or possibility of intercourse on her part, at some antecedent period. Now a medical jurist, when consulted in such a case, can only be guided by the presence or absence of the external signs of virginity. The hymen may be intact, but this does not prove non-intercourse, because females have been known to conceive with the hymen uninjured; and an operation for a division of this membrane has been frequently rendered necessary before delivery could take place. (Henke's Zeitschrift der S. A. 1843, vol. 2. p. 149.) Two cases of impregnation without rupture of the hymen are reported in the New Orleans Med. Gaz. for June 1858, pp. 217, 220. The hymen in each case required to be divided to allow of the delivery of the child. Another case is reported in the American Jour. Med. Sci. for April 1859, p. 576. These facts may be explained by the membrane being hard and resisting, and at the same time small in extent, *i. e.* only partially closing the vagina. Under opposite conditions, the persistence of this membrane might fairly lead to the inference that the female was chaste, and that there had been no intercourse; but the hymen may be destroyed by ulceration, as a result of inflammation of the genital organs. When the membrane has been thus destroyed by disease or other causes, or when it is congenitally absent, the opinion must be more or less conjectural; for one intercourse could hardly so affect the capacity of the vagina, as to render the fact evident through life, and there is no other datum upon which a medical opinion could be based. The presence of the hymen is of course quite incompatible with the assumption that the female has borne a child. A question of this kind incidentally arose in *Frazer* v. *Bagley* (Common Pleas, Feb. 1844). It was alleged by defendant, that the plaintiff, a married man, had had adulterous intercourse with a young female, and that at an antecedent period she had left her home for the purpose of giving birth to a child privately. The late Dr. Ashwell was called upon to examine the female, and he deposed that, in his opinion, she was a virgin, and had never had a child. The jury returned a verdict for the defendant. (See Henke, 1844, vol. 1. p. 259.) It is possible, however, that there may be abortion at the early periods of pregnancy, without this being attended with the destruction of the hymen.

This question may become of importance, not only as it may affect the reputation of a female, but the credibility and character of the person who makes the charge of a want of chastity. In 1845, a gentleman, then assistant-surgeon in the Bombay Army, was brought to a Court-Martial on a charge of having deliberately and falsely asserted that on several occasions he had had connection with a native female. This was denied by the woman, and evidence was adduced to show that she had still what is commonly regarded as the main sign of virginity, namely, an unruptured hymen. In consequence of this, the gentleman was found guilty, and cashiered. The native female was at the time about to be married, and this rendered the investigation all the more important. An assistant-surgeon, who examined the girl, deposed that he found the membrane of a semilunar form, and tensely drawn across the vagina; and his evidence was corroborated by that of a midwife. The inculpated party took up a double line of defence: 1. That the examination of the female was incomplete; 2. That the hymen, if present, would not justify the witness in saying that intercourse could not possibly have taken place. On the first point, it is unnecessary here to make a remark; but it appeared, from their own admission, that the witnesses had never before examined females with this particular object. Assuming that there was no mistake, it becomes a question whether non-intercourse could in such a case be inferred from the presence of the membrane. Fruitful intercourse, it is well known, may take place without rupture of the hymen. Some instances of this kind were referred to at the Court-Martial; but such cases may be regarded as of an exceptional nature. The real question is, whether, unless the hymen be in an abnormal state, intercourse can possibly occur between young and active persons without a rupture of this membrane. Intercourse is not likely to be confined, under these circumstances, to a mere penetration of the vulva. The membrane in this female is stated to have been tensely drawn across the canal, and it was not tough: it was therefore in a condition rendering it most easy for rupture. In the case of an old man, or of one of weak virile power, vulval intercourse might be had without destroying the membrane: but such a case could only be decided by the special circumstances which accompanied it. The presence of the hymen unruptured affords a presumptive but not an absolute proof that the female is a virgin; and if of the ordinary size and shape and in the ordinary situation, it shows clearly that there can have been no vaginal penetration. Admitting the statements of the examiners to be correct, it is improbable that this female had

had sexual intercourse on several or even on one occasion : hence the imputation on her chastity was unfounded.

In the case of *Delafosse* v. *Fortescue* (Exeter Lent. Ass. 1853), which involved an action for defamation of character, the plaintiff, a married man, æt. 64, had been charged with committing adultery with a certain female. Several witnesses for defendant positively swore that they had seen the parties in criminal intercourse. This was denied by the plaintiff; and, as an answer to the case, medical evidence was tendered to the effect that the female with whom the adulterous intercourse was alleged to have taken place had been examined, and the hymen was found intact. In cross-examination this was admitted not to be a conclusive criterion of virginity. A verdict was returned for defendant. The form and situation of the hymen in this case were not described; but it is to be presumed that these were not such as to constitute a physical bar to intercourse, or this would have been stated by the medical witness. Hence the existence of the membrane was not considered to disprove the allegations of eye-witnesses. In Scotland this kind of medical evidence is not admissible. I am indebted to Mr. Trayner, a member of the Scotch bar, for the subjoined case, in which a wife sued the husband for divorce, on the ground, *inter alia*, that he had committed adultery with C. In defence the defendant denied the adultery, and adduced C. as a witness, who swore that such connection had never taken place. She also swore that she had submitted to an *inspectio corporis* by Professor Simpson. The defendant then proposed to examine Dr. Simpson, that he might speak to the result of the examination. He argued that this was the best evidence that he could adduce in support of his innocence, as if the girl was still a virgin the adultery alleged could not have been committed. The Court refused to admit the evidence, on the ground that the evidence proposed was merely that of an opinion from the learned professor; that other medical men might differ from him in opinion, even on the same observations, and that as the Court could not compel C. to submit to another examination, the proposed evidence must be considered *ex parte* and inadmissible. (Session cases, Edinburgh, 11th February 1860.) In *Hunt* v. *Hunt* a verdict was obtained at common law against the alleged paramour in a case of adultery, and the damages were assessed at fifty pounds. It was subsequently proved that the lady was *virgo intacta!* So long as there are facts which show that females have actually conceived with the hymen still in its normal state, it is inconsistent to apply the term "virgo intacta" to females merely because this membrane is entire. A woman may assuredly have an unruptured hymen, and yet not be a virgo intacta. This can only be decided by the special circumstances proved in each case. Such *virigines intactæ* have frequently required the assistance of accoucheurs, and in due time have been delivered of children !

ON THE MARRIED.

The remarks already made, apply to married women, with this difference, that when a female has already been in habits of intercourse, there is commonly much less injury done to the genital organs. The hymen will, in these cases, be found destroyed, and the vulva dilated. Still, as the intercourse is presumed to be against the consent of the woman, it is most likely that under proper resistance, some injury will be done to the pudendum, and there will be also, probably, extensive marks of violence on the body and limbs. Such cases are generally settled without medical evidence, from the statement of the female alone, corroborated, as it should be, by circumstances. An experienced barrister has suggested to me that this statement regarding the presence of *marks of violence* on the pudendum of a married woman, on whom a rape is alleged to have been committed, requires some qualification. He informs me that he was concerned in the prosecution of two cases of rape on married females, in which the crime was completed in spite of the resistance of the female, and there were no marks of violence on the genital organs. In one (*Reg.* v. *Owen and others*, Oxford Circuit, 1839), it appears that while an accomplice held the head of the female, with her face downwards, between his thighs, the prisoner had forcible intercourse with the woman from behind,—her thighs having been first widely separated. In the second case, an accomplice held the woman down on a bed by her neck, while the prisoner separated her thighs, and thus had intercourse with her. She was examined nine hours afterwards by an experienced surgeon, and he found no mark or trace of violence or injury on or anywhere near her pudendum. There were bruises on her arms, neck, and legs, where she had been forcibly held down. In both of these cases, it will be seen that the woman had not to struggle with a single assailant: and there can be no doubt that if a married woman be rendered powerless by many being combined against her, or if she is rendered insensible by intoxicating drinks or narcotic vapours, a rape may be perpetrated without any injury whatever to the pudendum. The gentleman to whom I am indebted for the above cases has suggested that a separation of the thighs in a married woman will cause such a dilatation of the parts, as to render it easy for the male organ to penetrate the vagina without leaving any traces of violence on the labia of the female organs generally. This is undoubtedly the true explanation.

When a charge of this kind is made by a prostitute, it is justly received with suspicion, and the case is narrowly scrutinized. Something more than medical evidence would be required to establish a charge of rape under these circumstances. The question turns here, as in all cases of rape upon adult females, on the fact of *consent* having been previously given or not. This is the point at which the greater number of these cases of alleged rape break down; and it need hardly be observed, that this question has no relation to the duties of a medical witness;—all that he can do is to establish, occasionally, whether or not sexual intercourse has been had, with or without some violence. It is obvious that there may be some marks of violence about the pudendum, or on the person, and yet the conduct of the female may have been such as to imply consent on her part. We must not suppose, as it appears to be commonly done, that medical proof of intercourse is tantamount to legal proof of rape.

Possibility of perpetrating rape.—Some medical jurists have argued that a rape cannot be perpetrated on an adult female of good health and vigour; and they have treated all accusations made under these circumstances as false. Whether, on any criminal charge, a rape has been committed or not, is of course a question of fact for a jury, and not for a medical witness. The fact of the crime having been actually perpetrated, can be determined only from the evidence of the prosecutrix and of other witnesses. Still a medical man may be able to point out to the Court circumstances which might otherwise escape notice. Setting aside the cases of infants, idiots, lunatics, and weak and delicate females, it does not appear probable that intercourse could be accomplished against the consent of a healthy adult female, except under the following conditions:—1. When narcotics or intoxicating liquids have been administered to her, either by the prisoner or through his collusion. It matters not in a case of this kind, whether the narcotics have been given merely for the purpose of exciting the female, or with the deliberate intention of having intercourse with her while she was intoxicated,—the prisoner is equally guilty. (See *Reg.* v. *Camplin*, Law Times, June 28, 1845; also Med. Gaz. vol. 36. p. 443.) The nature of the substance whereby insensibility is produced is of course unimportant. Thus the vapours of ether and chloroform have been criminally used in attempts at rape. In a case which occurred in France, a dentist was convicted of a rape upon a female, to whom he had administered the vapour of ether. The prosecutrix was not perfectly unconscious; but she was rendered wholly unable to offer any resistance. (Med. Gaz. vol. 40. p. 865.) A dentist was recently convicted of rape under somewhat similar circumstances in the United States, but it was thought that the female had made the charge under some delusion. In *Reg.* v. *Snarey* (Winchester Lent Assizes, 1859), there was a clear attempt at fraud. The prosecutrix asserted that she was instantly rendered insensible, when the prisoner forced a handkerchief over her face, and she accused him of having committed a rape on her. The charge was disproved by a clear alibi as well as by the improbability of all the circumstances. It is not the property of chloroform to render persons instantaneously insensible.

When the state of unconsciousness arises from natural infirmity, as in idiocy or insanity, carnal intercourse with a female is regarded as rape. (*Reg.* v. *Ryan*, C. C. C. Sept. 1846.) The female was in this case an idiot, and it was proved that her habits were not loose or indecent. Platt, B. held that if she was in a state of unconsciousness at the time the connection took place, whether it was produced by any act of the prisoner or by any act of her own (?), any one having connection with her would be guilty of rape. The prisoner was convicted. In *Reg.* v. *White* (Northampton Winter Assizes, 1856), the learned judge, in charging the jury, stated that some doubts were entertained whether the crime of rape could be committed (in law) on the person of a woman who had rendered herself perfectly insensible by drink, so as to be unable to make any resistance. He thought it could not be alleged as an excuse for the man. The question was not reserved, as the prisoner was acquitted of the rape, and found guilty of an indecent assault.

It may be a question whether a man can have forcible intercourse with a female while in a state of *unconsciousness from natural sleep*. A man was charged with rape before a Police magistrate, and the prosecutrix swore that he had effected his purpose during her sleep. The bare possibility of the offence being perpetrated under these circumstances cannot be denied; but this admission would only apply to a case in which the sleep was preternatural or lethargic. In this instance the female was a prostitute, and the charge improbable. The condition of the so-called *magnetic*, or unnatural sleep, has given rise to a question connected with the alleged perpetration of rape. A girl (æt. 18) consulted a therapeutic magnetizer as to her health. She visited him daily for some days. Four months and a half afterwards she discovered she was pregnant, and made a complaint to the authorities against the magnetizer. They directed a physician and surgeon to determine the date of her pregnancy, and whether complainant might have been violated and rendered pregnant contrary to her will, *i. e.* if her volition could have been completely or partially annihilated by magnetism. The medical inspectors were satisfied that the pregnancy did not extend further back than 4½ months, and founding their opinion on M. Husson's report made to the Academy in 1831, concluded that as a person in magnetic sleep is insensible to every kind of torture;—sexual intercourse might therefore take place with a young female without the participation of her will, and without her being conscious of the act; and consequently without her being able to resist the act consummated on her. This opinion was confirmed by that of Devergie (Gazette Médicale de Paris, and Ed. Monthly Journal, Dec. 1860, p. 566.) There is another view of this case which does not seem to have occurred to the French medical jurists, namely, "*Non omnes dormiunt qui clausos habent oculos.*"

The state of the mind during the act of waking from natural sleep, *i. e.* when a person is in a half-conscious state, may also give rise to a question connected with rape. In *Reg.* v. *Clarke* (York Autumn Ass. 1854), prisoner was charged with having committed a rape on prosecutrix. The woman had been married to her husband six years, and had had three children. Prisoner took advantage of his absence from home to get into the bed of prosecutrix, about two o'clock in the morning: she mistook him for her husband, and under that mistake allowed him to have intercourse with her. It was only some time afterwards that she found it was the prisoner, and not her husband, who was in bed with her. The jury convicted him on this evidence. The case was reserved by Crowder, J., for the opinion of the judges whether the offence amounted to rape, as it was not included in the ordinary definition, *i. e.* of carnal knowledge by force and against the will of the woman. The pyschological question does not appear to have created difficulty, although it may be doubted whether under such circumstances the act could be perpetrated without the tacit consent of a woman.

2. A rape may be committed on an adult female if she falls into a state of syncope, or is rendered powerless by terror and exhaustion. An eminent judicial authority has suggested to me that, in his opinion, too great distrust is commonly shown in reference to the amount of resistance offered by women of undoubted character. Inability to resist from terror, or from an overpowering feeling of helplessness, as well as horror at her situation, may lead a woman to succumb to the force of a ravisher, without offering that degree of resistance which is generally expected from a female so situated. As a result of long experience, he thinks that injustice is often done to respectable women by the doctrine that resistance was not continued long enough. 3. When several persons are combined against the female, in which case we may expect to find some marks of violence on her person, if not on the genital organs (*ante*, p. 702.) 4. A woman may yield to a ravisher, under threats of death or duress, —in this case her consent does not excuse the crime: but this is rather a legal than a medical question. An aged woman can scarcely be expected to resist a strong man. Dr. Chevers men-

tions a case in which a man was convicted of rape and aggravated assault on a woman of *seventy* years of age.

Loss of physical evidence.—It is necessary to observe, in relation to the examination of adult females, that the marks of rape, however strong in the first instance, soon disappear or become obscure, especially in those who have been already habituated to sexual intercourse. After two, three, or four days, unless there has been an unusual degree of violence, no traces of the crime may be found about the genital organs. In unmarried females, and in children when there has been much violence, these marks may persist and be apparent for a week or longer. Supposing at the period of examination no such marks exist, it may be necessary to consider whether there has been time for them to disappear since the alleged perpetration of the offence; but in such cases it is rarely in a witness's power to express an affirmative opinion of the perpetration of the crime: he must leave this to be proved by the general and circumstantial evidence. Marks of violence on the person can never establish a rape; they merely indicate, *cæteris paribus*, that the crime may have been attempted.

Pregnancy following rape.—It was formerly a debated question, whether, in a case of real rape, pregnancy could possibly follow; and this was even proposed as a rude test of the truth of a charge made by a female! Such a question requires no discussion in the present day. Conception, it is well known, does not depend on the consciousness or volition of a female. If the state of the uterine organs be in a condition favourable to impregnation, this may take place as readily as if the intercourse was voluntary. Even penetration is not absolutely necessary for impregnation. (See case by Dr. Oldham, Med. Gaz. vol. 44, p. 48.) I am indebted to the late Mr. Carrington for a case in which a female became pregnant after a rape committed on her by a man who subsequently married her. The date of intercourse was accurately fixed, and the child was born after 263 days' gestation (see *ante*, p. 607).

Microscopical evidence.—As part of the medical evidence in cases of rape, it may be necessary to examine *spots or stains* on the linen of the prosecutrix and the accused. (Ann. d'Hyg. 1834, p. 210; 1839, p. 134.) Cases of rape are commonly tried in this country without reference to this species of evidence; and it is not easy to perceive how this can be necessary to the proof of the crime in the living, when the present law of England demands only proof of penetration, and not of *emission*. Thus, a rape may be legally completed without reference to emission; and, medically speaking, it appears quite possible that there might be marks of emission without any penetration. Admitting that certain stains of this description are found on the clothes of an accused party,—Are these to be taken as furnishing undeniable proof of the legal completion of rape? It appears to me that without corroborative proofs from the state of the female organs they cannot be so taken; and therefore the affirmative evidence from the microscope, under these circumstances, is as liable to lead to error as that which is purely negative. The fact that spermatic stains are found on the linen of the prosecutrix may, however, become occasionally of importance in charges of assault with intent; as the following case (*Reg.* v. *Hamilton*), which was tried at Edinburgh, Nov. 27th, 1843, will show. The prisoner, who was at the time labouring under gonorrhœa, was charged with a criminal assault upon a child. The shift worn by the prosecutrix, with other articles belonging to the prisoner, were submitted to Mr. Goodsir and Dr. Simpson for examination. Some of the stains on the linen were of a yellow colour, and were believed to be those of gonorrhœa; others, characterised by a faint colour and particular odour, were considered to be stains caused by the spermatic secretion. Digested in water, they yielded a turbid solution of a peculiar odour; and, when submitted to a powerful microscope, spermatozoa were detected. The majority of them were mutilated, the long slender filaments being broken off; but perfect specimens were seen, which differed from the living spermatozoa only in being motionless. The stains on the linen of the prisoner and the prosecutrix were similar. The prisoner was convicted of an assault with intent to ravish, and transported for fourteen years. (Cormack's Edinburgh Journal, April 1844.) In a case of rape perpetrated on a child, Dr. Sawyer found in addition to blood corpuscles and spermatozoa, some woollen fibres of a blue and red colour. This observation aided in fixing the identity of the assailant since it was proved that the man wore a red flannel shirt over a bluish-grey woollen shirt. (New Orleans Med. Gaz. June 1858, p. 281.)

Analysis of stains.—The are no chemical tests on which we can safely rely for the detection of spermatic stains. The appearance produced by a dried spermatic stain on linen or cotton is like that produced by a diluted solution of albumen. The fibre of the stuff is stiffened, and the borders of the stain have a slightly translucent appearance. It presents no well-marked colour. Slips of the stained linen, when soaked in a small quantity of distilled water, yield a muco-albuminous liquid. It was long since noticed by Orfila that this liquid, unlike albumen, was rendered rather strongly yellow by diluted nitric acid. By the action of warm water, the stained linen, even although it may have been kept dry for a considerable period, has been observed to evolve the peculiarly faint odour of the spermatic secretion.

The microscopical detection of spermatozoa is attended with some difficulty, especially when the stained portion of linen has been much rubbed or worn. M. Donné states that he has not succeeded in discovering these bodies in dried stains (Cours de Microscopie, 304); but this must have been owing to the faulty methods of proceeding adopted by some of the French medical jurists. They have recommended that the stained linen should be soaked in so large a quantity of water as to require filtration; that it should be macerated for many hours; that warm water should be used; and that ammonia or some other chemical agent should be employed. These circumstances will account for the non-detection of these minute fragile bodies, as they are liable to be disintegrated and destroyed by such methods of research. The plan which I have found the most simple is that recommended by Dr. Koblanek, of Berlin. (Vierteljahrschrift für gerichtliche und öffentliche Medicin, 1853, 3d B. 1 Heft p. 140.) Cut out a portion of the stained linen. Pour on it in a watch-glass, or small porcelain capsule, eight or ten drops of distilled water (enough to allow of a general soaking or imbibition of the stained linen). There should be no surplus water in the capsule. After soaking for about ten minutes, press out the watery liquid with a glass rod, aided by the fingers. A portion of this liquid, examined microscopically, will, if the stain be of a spermatic nature, yield evidence of the presence of these bodies. A high power of the microscope is required for this experiment. A spermatozoon is only indistinctly perceived by a most careful adjustment of the object glass under a power of 126 diameters. It becomes visible at 200 diameters; but here the tail and head may not be seen at the same time. Under a power of 340 diameters they are plainly visible. Dr. Koblanek employed 300 diameters, but used a second and more powerful instrument, to avoid the possibility of error.

The spermatozoon has a flattened, oval, and perfectly transparent body, terminating in a filiform tapering tail. According to Curling, it is from 1-500th to 1-600th of an inch in length. I found that the oval body of one had a length of 1-6000th of an inch, and a width of 1-12000th. The tail was about five times the length of the body, and the whole length of the spermatozoon was equal to about the 1-1000th of an inch. These bodies are the chief characteristics of the healthy spermatic secretion; and, when discovered, they clearly indicate that the stains under examination must have been caused by the seminal fluid. They differ in size and shape in different species of mammalia; but there are none that precisely resemble those which are found in the human secretion. Donné thinks it possible that the fine fibres of linen or cotton, washed from the stained stuff, might be mistaken for them. The microscopical characters of linen and cotton, however, ought to be sufficiently well known to an observer to prevent such a mistake from being made. Besides, medical evidence should be based on the undoubted detection of a perfect spermatozoon. Minute fibres might be mistaken for the tails; and therefore it is desirable not to base an opinion on fragmentary evidence of this description. Dr. Beale has published a case in which bodies closely resembling spermatozoa were found in the urine of a woman,—a patient in St. George's Hospital. (Archives of Medicine, No. 3, 1858, p. 251.)

Dr. Koblanek contends that, when they are not discovered by the process above described, it may be fairly asserted that the stains are *not* due to the spermatic secretion; but when the linen has been much rubbed, worn, or wetted by urine, blood, mucus, or pus, it will be a matter of considerable difficulty to discover these bodies, although there may really have been spermatic stains upon it. He has found that most of these foreign substances, however, may be removed by the addition of one or two drops of acetic acid, which exerts no dissolving action on the bodies of the spermatozoa unless too concentrated.

As it has been elsewhere stated (*ante*, p. 660), these bodies, although peculiar to the seminal fluid, are not found in the very young, the very old, or in those who are labouring under long-standing disease of the testicles. In addition to the other facts mentioned respecting their characters, it may be remarked that they move for many hours out of the body when kept at a temperature of 98°, and they even retain their rapid motions when the spermatic liquid is mixed with water; but these motions cease immediately on the addition of urine or chemical reagents. According to Müller, the spermatozoa may retain vitality (or free motion) in the body of a female for a period of seven or eight days, and even longer. When this vitality, indicated by free motion, has disappeared, the properties of the seminal fluid are destroyed, and there is reason to believe that it no longer possesses a fecundating power.

The detection of dead or motionless spermatozoa in stains may be made at long periods after emission, when the fluid has been allowed to dry. Dr. Koblanek made experiments on this subject in reference to different periods of time. He found these bodies distinctly,—after three days; one month; three, four, six, nine, and even twelve months. The number of distinct and perfect bodies diminished according to the length of the period at which the examination was made. Thus, at the end of a year, only two perfect specimens could be perceived; but it may be stated, that the discovery of one distinct and entire body is quite sufficient to justify a medical opinion of the spermatic nature of the stain. M. Bayard states that he has been able to detect them in stains after the long period of six years! (Man. Prat. de Méd. Lég. 277.)

Medical inferences.—A medical witness must be prepared to consider the precise value of evidence furnished by the microscope in the examination of stains on the dress of a man accused of rape. A shirt may present stains of urine, mucus, or gonorrhœal discharge, some of which, but for the microscope, might be mistaken for spermatic stains. Admitting that, by the process above described, the microscope enables an examiner to affirm that the stains have really been caused by the spermatic secretion, this does not prove that a rape has been committed, or even that intercourse has been necessarily had with a female. Such stains may arise from spontaneous natural discharge, or from disease (spermatorrhœa), and therefore in themselves they afford no proof of intercourse. If from other circumstances in the case it should be clearly and satisfactorily proved that there has been intercourse, then the presence of blood mixed with the spermatic stains might, in certain cases, justify an opinion that violence had been used. The discovery of spermatic stains on the dress of a female furnishes stronger evidence of intercourse attempted or perpetrated, than their discovery on the dress of a male; but admitting that intercourse is proved, it may still have taken place with the consent of the female. These stains, when found on the dress of female infants, afford a strong corroborative proof of the perpetration of the crime.

Microscopical evidence from the female.—It may become necessary to determine, in reference to a female, whether intercourse has or has not recently taken place. All observers agree that, within a certain period after connection, the fact may be established by the examination of the vaginal mucus. A small quantity of this mucus placed upon glass, and diluted with water, will be found to contain spermatozoa, if the suspicion be correct. M. Bayard states that he has thus detected them in the vaginal mucus of females not subject to morbid discharges, at various intervals up to three days after intercourse (Op. cit. p. 277); and Donné found them under similar circumstances in a female who had been admitted into the hospital the day before (Op. cit. p. 305). This evidence may become of value in a charge of rape; but it may be easily destroyed by the presence of leucorrhœa: and it is open to an objection, that, in certain morbid stages of the vaginal mucus of the human female, there is found in it a microscopic animalcule, called by Donné the *Trichomonas vaginæ*. This has a larger body, and a shorter tail, than the spermatozoon; but the witness who trusts to the use of the microscope on such occasions, may be fairly asked whether he is able to distinguish the spermatozoa from the trichomonades. They who are not used to microscopical investigations may be easily deceived, especially when the spermatozoa are dead and mutilated.

Marks of blood.—Marks of blood upon the linen can, of course, furnish no evidence unless taken with other circumstances. The linen may be intentionally spotted or stained with blood for the purpose of giving apparent support to a false accusation. Dr. Bayard met with a case of this kind, in which a woman charged a youth with having committed a rape upon her infant child. On examination, the sexual organs were found uninjured; and on inspecting the marks of blood on the clothes of the child, it was observed that the stains had been produced on the *outside*, and bore the appearance of smearing. The whole fibre of the stuff had not even been completely penetrated by the liquid. These facts established the falsehood of the charge. (Ann. d'Hyg. 1847, vol. 2. p. 219.) A case involving a false charge of rape was tried at the Glasgow Autumn Circuit in 1859. One of the witnesses, an accomplice, proved that she had purchased some blood and handed it to the female who made the charge, and she saw her smear it over her person and on some sheets on which it was alleged the rape was perpetrated. The woman (*Boyle*) and her husband, who made this false charge, were convicted of conspiracy. It may be a question whether marks of blood on the linen of the prosecutrix were caused by effusion as a result of *violence*, or by *menstrual discharge*. The menstrual fluid in the normal state is said to be entirely free from fibrin; but in respect to the red colour, the presence of red corpuscles and of serum, the two kinds of blood are similar. That fibrin is frequently present, and in large quantity, in the menstrual fluid, is obvious from its being occasionally discharged in a clotted state: hence the discovery of fibrin in a stain would by no means necessarily imply that the blood was from a wound, and not due to menstrual discharge, while its non-discovery would not prove the blood to be menstrual. Small quantities of fibrin are not readily separable from linen stained by blood as a result of effusion; and supposing the stain to have been caused by imbibition from another article of dress already stained, the secondary stain would be free from fibrin, which would remain in the stuff originally wetted. A man might thus wrongly pronounce this secondary stain to be due to menstrual blood. The discovery of epithelial scales and mucus, by the microscope, would not prove the stain to be menstrual, unless it could be shown that the mucus was effused with the blood which caused the stain (see *ante*, p. 584). The epithelial scales found in the vaginal mucus are of the tessellated variety. They are flat nucleated cells, oval, round, or polygonal in shape, and varying in size. They are spread over the mucous membrane, not only of the vagina, but of the mouth, pharynx, œsophagus (gullet), conjunctiva, and the serous and synovial membranes. There must be some caution in relying upon this microscopical evidence. (Kirkes's Physiology, p. 304.) It may be right to state, for the information of medical practitioners who have hitherto thought that they could easily distinguish menstrual blood, and swear to it, on charges of rape, that, a few years since, the French Academy of Medicine appointed as a committee, MM. Adelon, Moreau, and Le Canu, to examine this question in the most comprehensive manner. These gentlemen reported, that, in the present state of science, there is no certain method by which menstrual blood can be distinguished from that effused from the blood-vessels in a case of infanticide or abortion. (Ann. d'Hyg. 1846, vol. 1. p. 181. See *ante*, p. 584.)

Evidence of violation in the dead.—Sometimes the body of a female is found dead, and a medical witness is required to determine whether her person has or has not been violated before death. There is here some difficulty, because there will be no statement from the prosecutrix herself. The witness can seldom do more than express a conjectural opinion, from the discovery of marks of violence on the person and about the genital organs. Even if spermatozoa were detected in the liquid of the vagina, or on the dress of a female, this would merely prove that there had been intercourse: whether violent or not, must depend on circumstantial evidence. In a case tried at Edinburgh some years ago, the first point to determine was, whether a rape had been committed. The examination of the stains on the dress was conclusive, when taken in conjunction with some other pieces of circumstantial evidence. The jury convicted the man of a rape, and yet acquitted him of the murder, although the proof of the latter crime was clearer than that of the rape!

Legal relations.—The statute-law which refers to this crime is the 9 Geo. IV. c. xxxi. s. 17, 18. According to the eighteenth section, "Carnal knowledge shall be deemed complete upon *proof of penetration* only." The words are, perhaps, not sufficiently precise; for by one judge the law was thus interpreted: Carnal knowledge, *i. e.* penetration, is not complete, unless the hymen is ruptured. This, as it has been suggested, would divide penetration into vulval and vaginal: the former not constituting rape, but a common assault. The majority of the judges, however, have not admitted a distinction of this kind. They have strictly adhered to the obvious and literal meaning of the words of the law, and have regarded the rupture of the hymen not as a necessary proof, but as strong evidence of penetration. The question of penetration is not for the medical witness, but for the jury to decide from the whole of the facts. In the case of a child, the prisoner was seen perpetrating the act; but it was proved that the hymen, which was normally placed, was not ruptured: yet this case was decided like that of *Rex* v. *Russen*: the crime was considered to have been completed. Thus, then, when the material evidence of penetration (rupture of the hymen) is wanting, proofs may be derived from other and non-medical sources.

Rape by females on males.—So far as I can ascertain, this crime is unknown to the English law. Several cases of this kind have, however, come before the French Criminal Courts. In 1845, a female, aged 18, was charged with having been guilty of an act of indecency, with violence, on the person of Xavier T., a boy under the age of 15 years. She was found guilty, and condemned to ten years' imprisonment. In another case, which occurred in 1842, a girl, aged 18, was charged with rape on two children,—the one 11, and the other 13 years of age. It appeared in evidence that the accused enticed the two boys into a field, and there had forcible connection with them. This female was proved to have had a preternatural contraction of the vagina, which prevented intercourse with adult males. She was found to be labouring under syphilitic disease; and the proof of her offence was completed by the disease having been communicated to the two boys. She was condemned by the Court of Assizes of the Seine, to fifteen years' hard labour at the galleys. (Ann. d'Hyg. 1847, vol. 1. p. 463.) By the penal code of France, it is a crime in either sex to attempt intercourse with the other, whether with or without violence, when the child is under eleven years of age. That this offence is perpetrated in England cannot be doubted. It is by no means unusual to find, in the wards of hospitals, mere boys affected with the venereal disease. In some instances this may be due to precocious puberty; but, in others, it can only be ascribed to that unnatural connection of adult females with male children, which is punished as a crime in the other sex. The only accessible medical proof would consist in the transmission of gonorrhœa or syphilis from the woman to the child.

SODOMY. BESTIALITY.

This crime is defined, the unnatural connection of a man with mankind or with an animal. The evidence required to establish it is the same as in rape, and therefore penetration alone is sufficient to constitute it. There are, however, two exceptions: it is not necessary to prove the offence to have been committed against the consent of the person upon whom it was perpetrated; and 2ndly, both agent and patient (if consenting) are equally guilty; but the guilty associate is a competent witness. In one case (*Rex* v. *Wiseman*), a man was indicted for having committed this offence with a woman, and a majority of the judges held that this was within the statute. Unless the individual be in a state of insensibility, it is not possible to conceive that this offence should be perpetrated on an adult of either sex against the will of a person. The slightest resistance will suffice to prevent its perpetration. In August 1849, a question on this point was referred to me from Kingston, Jamaica. A man was convicted, and sentenced to transportation for life, for the crime of sodomy, alleged to have been committed on the complaining party while he was asleep. The only evidence against him was the statement of the complainant. The opinion given was in conformity with that of Dr. J. Ferguson, who referred the case to me, namely, that the perpetration of the act during a state of natural sleep was contrary to all probability. The remarks already made in reference to rape during sleep may be applied with greater force to acts of this nature. (See p. 704.) If this crime be committed on a boy under fourteen years, it is felony in the agent only; and the same, it appears, as to a girl under twelve. (Archbold, 409.) The act must be in the part where it is usually committed in the victim or associate of the crime, and if done elsewhere it is not sodomy.

The facts are commonly sufficiently proved without medical evidence, except in the cases of young persons, when marks of physical violence will in general be sufficiently apparent. In some instances, proof of the perpetration of the crime may be obtained by resorting to microscopical evidence. (See Donné, Op. cit. 305.) Stains upon the linen of young persons may thus furnish evidence that the crime has been attempted, if not actually perpetrated. Trials for this crime are very frequent, although it was not, like rape, specially excepted from capital punishment by the 4th and 5th Vict. cap. lvi. It is also said to be on the increase. (Law Times, Jan. 4th, 1845.) There cannot be the slightest doubt that false charges of this crime are more numerous than those of rape, and that this is too often a successful mode of extortion. This is rather a legal than a medical question; but it is especially deserving of notice, that these accusations are very frequently made by soldiers and a bad class of policemen!

ASPHYXIA.

DROWNING.

CHAPTER 59.

DROWNING — CAUSE OF DEATH — DEATH FROM SECONDARY CAUSES — PERIOD AT WHICH DEATH TAKES PLACE — APPEARANCES IN THE DEAD BODY — CHANGES PRODUCED BY PUTREFACTION — WAS DEATH CAUSED BY DROWNING ? — STATE OF THE SKIN — SUBSTANCES GRASPED IN THE HANDS — WATER IN THE STOMACH — MUCOUS FROTH IN THE TRACHEA AND LUNGS.

When a person falls into water, and is exposed to this kind of death, vain attempts are in the first instance made to respire: at each time that he rises to the surface a portion of air is received into the lungs, but owing to the mouth being on a level with the liquid, water enters into this cavity. A large quantity of water thus usually passes into the mouth, which the individual feels himself irresistibly compelled to swallow. The struggle for life may continue for a longer or shorter period, according to the age, sex, and strength of the person; but the result is, that the blood in the lungs is not oxygenized, and the individual becomes exhausted. The mouth then sinks altogether below the level of the water, air can no longer enter into the lungs,—a portion of that which they contain is expelled, and rises in bubbles to the surface: an indescribable feeling of delirium, with a ringing sensation in the ears, supervenes,—the person then loses all consciousness, and sinks asphyxiated. Before death, and while the body is submersed, frequent attempts are made to breathe, but at each effort air escapes from the lungs, so that these organs may, according to the duration of the struggle, become more or less emptied, and even be found collapsed after death. During the state of asphyxia dark-coloured blood is circulated,—convulsive motions of the body follow, and the contents of the stomach are sometimes ejected prior to dissolution. There is not the least sensation of pain, and, as in other cases of asphyxia, there is a total unconsciousness of suffering during the period when the access of air is cut off from the lungs. I state this from having accidentally experienced all the phenomena of drowning up to the complete loss of sensibility and consciousness. (See, in reference to the phenomena of asphyxia from drowning, a paper by Mr. Eeeles, Med. Gaz. vol. 44. p. 657.)

Some persons who fall into water are observed to sink at once without making any attempt to extricate themselves. This may arise from the stunning or shock produced by the fall; and if the fall take place from a great height, the effect is probably aided by the forcible compression which the thorax then sustains, whereby the lungs are in great part emptied. Should the person be intoxicated or otherwise incapacitated, as by striking his head in falling, he may not again rise. These different conditions under which death may take place will sufficiently account for the great difference in the appearances met with in the bodies of those who have been said to die by drowning. Some medical jurists have considered that they who are submerged while living, frequently perish by *syncope*, and in other instances by what has been termed syncopal asphyxia—a mixed condition. It has been supposed that the state of terror into which a person may be thrown prior to submersion, would be sufficient to bring on syncope; and this, it was presumed, offered an adequate explanation of the recovery of the apparently drowned, when the body had remained a long time in water. It may readily be admitted that in some instances the mental shock may be so great to a person falling into water, as to induce syncope, especially in females; but the occurrence of this state appears to be founded rather upon presumption than upon actual observation.

Death from secondary causes.—Drowning may operate indirectly as the cause of death. Thus it has been repeatedly remarked that persons who have been rescued from water in a living state, have died, in spite of the application of the usual restoratives, after the lapse of some minutes or hours: others have lingered for one or two days, and then have sunk apparently from exhaustion. In those who perish soon after removal from the water, death may arise from the exhaustion produced by the struggles for life, aided by the long contact of the body with a cold medium. In the case of *Mr. Gudge* (May 1857) death was owing to the secondary effects of submersion. The deceased was removed from the water and conveyed to the Westminster Hospital. He was cold and insensible, but he breathed tolerably well and had a fair pulse. In about three hours, he became conscious and spoke a little. The insensibility subsequently returned accompanied by great difficulty of breathing, and he died in about twenty hours from the time of submersion. Dr. Marcet states that spasm of the glottis has been among the severe secondary symptoms in those who have been removed from water apparently drowned. A severe spasm of this kind manifested itself in one case while placing the person in a warm bath. (Med. Times and Gazette, Feb. 7, 1857, 148.)

When death occurs at a remote period, it may be due to disease; and the question will then be, whether the disease was produced by the immersion in water or not. Such cases occasionally present themselves before our Courts of Assize. In one of these (*Reg.* v. *Pulham*, Gloucester Summer Assizes, 1845), the prisoner was charged with the death of deceased by pushing him into a pond of water, from the effects of which he died. The deceased was an old man; he was taken out the water in an exhausted condition, and he died a few weeks afterwards. One medical witness referred death to the effects of the immersion; but as he had not attended the deceased after the violence, and there was no clear account of the cause of of death, the prisoner was acquitted. In most of these cases it will be found exceedingly difficult to connect death with the immersion, when the fatal result does not take place until after so long a period of time. We must on such occasions rely, for the basis of our evidence, upon the nature of the disease alleged to have been caused by immersion,— *e. g.* inflammation of some cavity or organ, and on its progress until death without intermediate recovery or aggravation by improper treatment.

According to Mr. Devergie (Méd. Lég. vol. 2. p. 336), of one hundred individuals who fall into the water, or are exposed to the chances of drowning, the following may be taken as the numerical ratio of the causes of death: —

Asphyxia, pure	25·0		Asphyxia	87·5
——— and Syncope	62·5			
——— Cereb. Congestion				
Syncope, Apoplexy, or Concussion				12·5
				100·0

From this table we learn that out of one hundred bodies removed dead from water, where death was due either directly or indirectly to immersion,— if the dead body were removed immediately after death, and examined soon after removal, the signs of drowning would be present in about 25: — they would be imperfectly apparent (asphyxia more or less marked) in about 62, and they would be wholly absent in about 12. This table may not represent the actual truth, but as the medical jurists of Paris have ample opportunities of examining the drowned, it is probably as near an approximation as the present state of science will permit us to reach. For a full examination of the causes of death in drowning, by Dr. Loeffler, see Henke, Zeitschrift der S. A. 1844, vol. 1. p. 1.)

Period at which death takes place.—Some persons who are strong, who are good swimmers, and retain their presence of mind, may support themselves for a length of time in water, while others who are weak and delicate may struggle only for a few seconds, and then sink exhausted and lifeless. There are two very different points involved in this inquiry: — 1. How long can a person remain beneath the surface of water without becoming asphyxiated (drowned?), and 2. After what period of entire submersion of the body may we hope to resuscitate a person? In regard to the first point, it may be remarked, that when the mouth is so covered that air cannot enter, asphyxia supervenes in the course of one or two minutes at the farthest, and the time at which this occurs does not appear to vary materially with the individual. It has been observed that perfect insensibility has supervened after a minute's submersion, and it is probable that in most cases a few moments would suffice for the commencement of asphyxia. In the case of a healthy diver who was accidentally submersed, at Spithead, in July 1842, for *a minute and a half* without the power of breathing, at the depth of eighty feet it was observed that when drawn up he was faint but sensible. (Med. Gaz. vol. 31. p. 90.) Observations made upon sponge and pearl-divers show for how short a period a human being, even when practised in the art of diving, can continue without breathing. Dr. Lefevre, of Rochefort, found that among the Navarino sponge-divers, accustomed as they were to the practice of diving, there was not one who could sustain entire submersion of the body for *two consecutive minutes.* The average period of entire submersion was seventy-six seconds. (Med. Gaz. vol. 14. p. 608.) According to Mr. Marshall, the best pearl-divers of Ceylon could rarely sustain a submersion of more than fifty seconds. Thus, then, it would appear from these and other observations, that asphyxia is probably induced in most persons in the course of a few seconds, and that at the furthest it occurs in from a minute to a minute and a half. But asphyxia is not synonymous with death, and while in many persons asphyxia may commence at or about the same period of time, there are probably few in whom, under complete submersion, the circulation would be arrested or death take place at precisely the same instant of time. Such a simultaneous arrest of the action of the heart in two individuals must of course be the result of a pure coincidence. This medical question may be occasionally of importance in reference to presumption of survivorship, as when husband, wife, and children have died from drowning under a common calamity. As to the period at which a person may be resuscitated there are cases on record in which recovery has taken place under treatment, after thirteen and fourteen minutes' submersion.

Appearances after death.—When a person dies in the water, the body generally sinks,—the specific gravity of the dead body being greater than that of water. In some instances, however, the bodies of the recently drowned have been observed to float on the surface. This may arise from various accidental circumstances,—the lightness of the skeleton or the osseous part,—the predominance of fat,—the effect of air retained by the clothes,—or the presence of gases either from natural causes during life — or as a result of putrefaction after death in the contents of the stomach and intestines. The normal specific gravity of the body differs but little from that of water, so that slight causes will prevent it from sinking, or bring it to the surface, if it has already sunk.

In conducting an examination of the body of a drowned person, it is necessary to remember that the external and internal appearances vary much, according to the length of time during which it may have remained in the water, or the period that may have elapsed after its removal and before it is examined. Two subjects may be taken out of water at the same time — one may be examined immediately, while the examination of the other may be deferred for several days. In these cases the appearances after death will be no longer similar; and the differences will be particularly great, when the last-mentioned body has been exposed to a high temperature and to the free access of air. *Externally.*—Supposing that the body has remained in the water only a few hours after death, and the inspection has taken place immediately on its removal, the *skin* will be found cold and pallid — sometimes contracted, under the form of cutis anserina. (Ed. Med. and Surg. Jour. Jan. 1857.) This contracted state of the skin furnishes strong evidence of the body having gone into the water living (see *post*, p. 725). The skin is often covered to a greater or less extent by livid discolorations. The face is pale and calm, with a placid expression, the eyes are half-open, the eyelids livid, and the pupils dilated; the mouth closed or half-open, the tongue swollen and congested, frequently pushed forwards to the internal edges of the lips, sometimes indented or even lacerated by the teeth; — and the lips, together with the nostrils, covered by a mucous froth which oozes from them. A singular external appearance has been noticed by Kanzler in reference to the male subject — namely a remarkable retraction of the penis. In men who have gone living into the water and been drowned, this appearance has been observed by Casper and Kanzler; and the former states that he has not met with this condition of the male organ after any other form of death. In strong and robust men, the organ has been found very short, and strongly retracted into the skin. (Ger. Leich.-Oeffn. vol. 2. p. 109.)

In general, when the dead bodies of the drowned are taken from water, the limbs are found relaxed; but this must depend on the period at which they are removed. Convulsions are known to precede death by asphyxia, but the effects of these on the body are generally lost when the person dies. Rigidity of the muscles takes place after death in water, perhaps more rapidly than in air. If the water is intensely cold, and the individual has struggled violently, the last struggles of life may be indicated by the contorted state of the limbs persisting through rigidity. Mr. Beardsley, a former pupil, has communicated to me the following case. A young man, while skating, fell through the ice of a pond about seven yards deep. This was in February 1847. He was not totally immersed, for he kept his head and shoulders out of the water above the ice, with his arms resting upon it; and as the ice gave way under his weight, he sprang to a fresh portion. Before assistance could be rendered, he sank to the bottom. The body was removed the next day; it was found at the bottom of the pond, beneath the hole in the ice. The arms of the deceased were quite stiff, and still retained the position in which he had rested upon the ice: his legs were quite extended, and the muscles on the fore part of the thigh were very much contracted, as if they had been powerfully exerted in keeping him erect while he was hanging on the ice. There was no appearance of his having attempted to breathe after he had gone below the water. His countenance was quite natural, and there was no water or froth in his mouth; the external appearances resembled those which are seen in a body immersed after death from some other cause. There was no internal inspection. Mr. Beardsley's opinion was, that the water being about 32°, the man was in reality killed by cold, or frozen: and there is no doubt, that if this did not operate as the direct cause of death, it materially accelerated it.

This case is of interest in reference to the fact of drowned persons being often discovered with substances firmly grasped in their hands. A contracted state of the muscles at the time of death may pass into perfect rigidity by the effect of cold water: and thus the attitude, or the last act of life of the individual, may be preserved. It is precisely analogous to that condition which has been called cadaveric spasm.

If the body has been submerged for a long period, or has remained long exposed before inspection, the skin will be found variously discoloured, according to the degree to which putrefaction may have advanced. If three or four months have elapsed before its removal from water, the skin covering the legs may be, in the first instance, of a deep blue colour: but when the body is exposed to air, this colour gradually disappears, and the skin becomes of a dirty brown with a tinge of green. The influence of air upon the skin of a drowned subject is most remarkable in the face and thorax. When the body has remained for some days in water, and has been exposed for a few hours only after its removal, the temperature of the atmosphere being moderately high, the face will commonly be found livid and bloated, and the features so distorted that they will be with difficulty recognized. The change chiefly consists in the skin becoming at first of a livid brown colour, which gradually passes into a deep green. That these effects are to be ascribed to the free contact of air, appears evident, from the fact that they are most fully developed in those parts of the body which are the most exposed to the atmosphere. Thus the changes of colour in the skin are not commonly met with where any parts of the cutaneous surface have been in close contact, as in the armpits and inner surfaces of the upper and lower extremities, where the former have been closely applied to the sides of the trunk, and the latter have remained in close proximity to each other. For the same reason, the discoloration is not commonly observed at the back of a subject, or in those parts where the body has been closely wrapped in clothes. The changes from *putrefaction*, even when these are comparatively slight, may, as Casper justly remarks, seriously affect the value of medical evidence. The blood becomes decomposed, acquires a darker colour, and produces congestions in the brain, lungs, right side of the heart, and other parts of the body, so as to render it difficult to form a conclusion on death from apoplexy or asphyxia. (Gerichtliche Leichen-Oeffnungen, vol. 1. p. 89.)

The special researches on drowning made by Casper and Kanzler show that putrefaction of the bodies of the drowned generally commences at the upper part and extends downwards. Thus, after a few days, while the lower part of the body may be in a tolerably fresh condition, the face, head, neck, and upper part of the chest may present a reddish colour passing into patches of a bluish-green, first seen on the temples, ears, and nape of the neck, thence spreading to the face, and afterwards to the throat and chest. These changes may be observed in summer when a body has remained in water from eight to twelve days, and in winter at a still later period. The head of a drowned person is sometimes much discoloured from putrefaction, when the rest of the body may preserve its ordinary condition. Casper considers that this inverted order of the putrefactive process may be taken as a strong indication of death from drowning (Ger. Leich.-Oeff. vol. 2. p. 103); but while it may be admitted that attention should be given to this circumstance, it yet remains to be proved whether a dead body thrown into water (when death has taken place from asphyxia by suffocation or strangulation) would not undergo decomposition in a precisely similar manner. It is worthy of remark that the uterus resists decomposition more than other internal organs. In a case in which the body of a female, who had been missing nine months, was found and examined, although all other parts were completely decomposed, the uterus was of a reddish colour,—firm in structure, and its parts were recognizable, so that Casper, who examined the case, was able to affirm that the female was not pregnant at the time of her death. (Ger. Leich.-Oeff. vol. 1, p. 93.)

There is another external appearance which is sometimes met with in the drowned: the fingers or surface of the body may occasionally present *abrasions;* and gravel, sand, or other substances, may be found locked within the hands or nails of drowned subjects; for in the act of drowning, as common experience testifies, an individual will grasp at any object within his reach, and in his efforts to extricate himself he may excoriate or wound his fingers. There are, however, many cases of drowning, in which this appearance is absent. There may be no substance for the drowning person to grasp:—this will depend in a great degree upon the fact of the water being deep or shallow, of its being confined within a narrow channel or not, and many other contingencies. In all cases, when the person is senseless before he falls into the water, or when his death is occasioned by syncope from sudden terror, he will, of course, be incapable of making those exertions which are necessary to the production of this appearance, and it is probable that this frequently occurs among females who are accidentally drowned. When the body has remained several days in water, the skin of the palms of the hands and soles of the feet is found thickened, white, and sodden, as a result of imbibition.

Internally.—On examining the body internally, we may expect to find, in a recently drowned subject, that the viscera of the chest will present the appearances usually indicative of asphyxia. The venous system is generally gorged with dark-coloured blood. If death has not taken place from asphyxia, or if the subject has remained a long time in water before an inspection is made, the viscera of the chest will not present the characters about to be described. Some physiologists have asserted that the *blood* remains fluid in the bodies of the drowned. Orfila has stated, that, with one exception, he had not met with blood in a coagulated state. Much more importance has been attached to this appearance than it really merits. Some observers have found the blood coagulated in the drowned: and I have repeatedly seen coagula, like those usually met with after death, in the bodies of animals which were drowned for the sake of experiment. If the blood be generally found liquid, this may be due to the imbibition of water, or to putrefactive changes. The state of the blood in the drowned, formed a subject of inquiry in the case of *Reg.* v. *Barker and others* (York Winter Assizes, 1846). From the remarks above made, it will be perceived that it may be found either coagulated or uncoagulated in those who go into the water living, and die by drowning. The state of the *lungs* is of considerable importance: they are more frequently found distended than collapsed. According to Dr. Riedell, they are very flabby and greatly increased in weight. The accurate observations of Casper and Kanzler show that the lungs of the drowned are, as a general rule, greatly increased in volume: they appear as it were inflated, and completely fill the cavity of the chest. This increase of volume does not depend entirely on that congestion or fulness of blood which is a result of asphyxia in drowning; for Casper states he has met with this augmentation of volume in those cases where death had taken place suddenly in the water from apoplexy or other causes than asphyxia. (Ger. Leich.-Oeff. vol. 2. p. 112.) The state of the *heart* in the drowned has given rise to some discussion. In asphyxia, the right cavities are, I believe, generally found to contain blood; while the left cavities are either empty, or they contain much less than the right. Out of fifty-three inspections made by Dr. Ogston, the right cavities were found empty only in two cases, and the left cavities empty in fourteen. (Med. Gaz. vol. 48. p. 291.) In a case of drowning, which was examined by Mr. Bishop, the right side of the heart contained scarcely any blood; and in another case communicated to me December 1857, the only medical difficulty regarding death by drowning, presented itself in an emptiness or non-distension of the right cavities of the organ. The facts and observations accumulated by my friend, Dr. Norman Chevers, of the Calcutta Medical Board, show that a full condition of the heart, although a common, is not an invariable, concomitant of asphyxia either from drowning or from any other cause. (Medical Jurisprudence for India, 1856, p. 441.) It has been elsewhere remarked, that the action of the heart continues after the stoppage of respiration, and that the period at which this organ ceases to contract is variable. Hence, in some cases, there may be sufficient power in the right cavities to contract upon their contents, and to expel, more or less completely, the last traces of blood received by them from the body. Emptiness of the right cavities of the heart must not, therefore, be regarded as inconsistent with death from drowning; at the same time, it cannot be taken as a proof that the person has died from asphyxia. As in death from strychnia, prussic acid, and other causes, the condition of the right cavities of the heart as to fulness or emptiness, is more closely connected with the mode of dying, than with the actual cause of death.

A greater or less fulness of the vessels of the *brain* is described as one of the appearances met with in a drowned subject; but this, when it exists, is probably a consequence of a congested state of the lungs. Some remarks have been already made on this subject, and from these it is evident, that the state of the cerebral vessels can afford no presumption that death has taken place by drowning. In regard to the cases which I have had an opportunity of examining, the quantity of blood contained within the cerebral vessels has rarely been so great as to call for particular notice.

In examining the viscera of the abdomen, it will commonly be found that the *stomach* contains a certain quantity of water, which appears to enter into this organ during the struggle for life, by the act of swallowing. This may be salt or fresh, according to the medium in which the drowning has taken place. The quantity is subject to great variation; sometimes it is large, at other times small: and in some instances, no water whatever is to be met with. The absence of water may probably indicate a rapid death, as there could have been no power to swallow. Orfila has remarked, that the mucous membrane of the stomach and bowels is occasionally much discoloured in drowned subjects. He observed, also, that when drowning took place while the process of digestion was going on, the mucous membrane of the stomach often had a pinkish red or violet tint. When the drowned subject had remained a long time in water, this membrane was observed to acquire a deep violet or brown colour. A knowledge of this fact will be of importance in those cases in which the subject removed from water is suspected to have been poisoned previously to submersion. Among the other internal appearances met with in the body of a recently drowned person, which require to be mentioned, is the presence of a *mucous froth*, sometimes of a sanguineous hue, covering the lining membrane of the trachea, which may be itself slightly reddened. Water is, also, occasionally found in the ramifications of the air-tubes, but in variable quantity. If the body has remained a long time in water, or if, after removal, it has been exposed to the air several days previously to an inspection being made, there is commonly no appearance of mucous froth in the trachea or its ramifications. It has been said that the diaphragm is generally much raised towards the chest, but this depends on putrefaction, and the increase in the size of the abdomen by the formation of gas in the intestines. The urinary bladder in some cases contains urine; in others it is perfectly empty. Casper found it empty in one half of the cases which he examined. It is obvious that the state in which the bladder is found must depend on its condition at the time at which the drowning occurred. (See, in reference to the appearances in the drowned, a paper by Dr. Ogston, Med. Gaz. vol. 47. pp. 763, 854, *et seq.*; also another by Dr. Riedell, Med. Gaz. vol. 46. p. 478; and Casper, Ger. Leich.-Oeff. vol. 1. p. 87; 2. p. 105.)

Was death caused by drowning?—It is obvious that for a correct solution of this question, we shall have to consider the appearances met with in the drowned, and to determine how far they are characteristic of this form of death. Among the *external* signs of drowning, when the body is seen soon after death, are paleness of the surface, a contracted state of the skin (cutis anserina), and the presence of a mucous froth about the nostrils and lips. The absence of these appearances, however, would not prove that the person had not been drowned; for if the body has remained some time in water, or if it has been long exposed to air before it is seen by a medical practitioner, the skin may have undergone various changes in its condition and colour. and mucous froth may no longer be found adhering to the nostrils and lips.

State of the skin.—The goose-skin or cutis anserina is frequently observed in the drowned, and according to Casper it is a common accompaniment of death by drowning. Like the other appearances it is not always met with, and a question has arisen whether, when it exists, it can be regarded as an unequivocal sign of death from drowning, or rather of a person having gone into the water living. Wagner believed that it might occur in a dead body submerged while still warm: but in Casper's opinion, the most important fallacy to which this appearance is liable, is the fact that many persons have naturally a hard rough or horny skin, which might be mistaken for the goose-skin, resulting from contact with cold water. (Ger. Leich.-Oeff. vol. 1. p. 89.)

Substances grasped in the hand.—In speaking of the *external* appearances of the body, it was stated that foreign substances are sometimes found locked within the hands, or lodged under the nails of drowned subjects. This fact may occasionally afford strong circumstantial evidence of the manner in which the person has died. If materials be grasped within the hands of the deceased which have evidently been torn from the banks of a canal or river, or from the bottom of the water in which the body is found, we have strong presumptive evidence that the individual died within the water. For although it is possible to imagine that the deceased may have struggled on the bank and have been killed prior to submersion, yet in the value attached to this sign we are presuming that there are no marks of violence on the person, nor any other appearances about the body sufficiently striking to lead the examiner to suspect that death has taken place in any other way than by drowning. If the substance locked within the fingers or finger-nails, is sand of the same character as that existing at the bottom of the river or pond, it is difficult to conceive any stronger evidence to establish the fact of death having taken place subsequently to submersion. The abrasion of the fingers is a circumstance of minor importance,—no value could be attached to this state of the fingers as an indication of the individual having perished by drowning, unless it were in conjunction with the appearances above described. A witness would be constrained to admit, in many cases, that the extremities of the fingers might become abraded or excoriated after death, or even before submersion, while in no case could he be called upon to make, in regard to substances found grasped within the hands, an admission which would invalidate the evidence deducible from this condition. This must be regarded as satisfactory evidence of the individual having been alive after his body was in the water. It is well known that when two or three persons are drowned by the same accident, they are not unfrequently found clasped within each other's arms,—a fact which at once proves that they must have been living when submerged. So if a dead body be discovered still holding to a rope, cable, or oar, no further evidence is required to show that the deceased must have died by drowning. The signs upon which medical jurists chiefly rely as proofs of death from drowning, are,—1. water in the stomach; and 2. water with a mucous froth in the trachea and lungs.

1. *Water in the stomach.*—It has been remarked that water commonly passes into the stomach of a living animal while drowning, as a result of the act of swallowing. It has been observed, that when an animal is stunned prior to submersion, water does not pass into the gullet, and when syncope occurs none will be found. As a proof that its entrance into this organ depends on deglutition, it may be stated that the quantity contained within the stomach is greater when the animal is allowed to come frequently to the surface and respire, than when it is maintained altogether below the surface. The power of swallowing is immediately suspended on the occurrence of asphyxia, and in this way we may satisfactorily account for the difference observed in the two cases. The water thus found is in variable quantity: and there are some cases of drowning in which water is *not* discovered in the stomach. It was found by Dr. Ogston, of Dundee, in five cases out of seven. (Ed. Med. and Sur. Jour. Jan. 1837.) In dissecting cats, which had been drowned, I have repeatedly remarked the absence of water from the stomach: in these instances the animals had been invariably kept under water from the first moment of their submersion, and thus in a condition but little favourable to the exercise of deglutition. Water does not readily penetrate into the stomach of a body which has been thrown in after death: the sides of the gullet applying themselves too closely to each other to allow of the passage of fluid. If putrefaction has

advanced to any extent, it is possible that some water may enter; but a practitioner will easily judge from the general state of the body how far this process may have been concerned in the admission of fluid into the stomach and alimentary canal. Orfila has suggested that water may be found in the stomach of a person apparently drowned, in consequence of this liquid having been drunk by deceased, or artificially injected by another into the stomach after death. It is difficult to conceive under what circumstances such an objection could be made, or what purpose it would answer. In relying upon the presence of water in the stomach, it must not be forgotten that the deceased may have drunk water before his body was submerged. The body of a child, aged two years, was taken out of a piece of water and inspected. The usual appearances of drowning, with one exception, were absent. There was no congestion in the brain or lungs, there was emptiness of the cavities of the heart, no water in the air-passages, and thus a want of evidence of death from apoplexy or suffocation. The blood was of a clear red colour, and very fluid: the stomach was almost filled with water, in which a portion of the food floated. No cause of violent death was apparent on inspection. The presence of water in the stomach was explained by the fact that the child had been playing with its nurse on the banks of the stream. It complained of intense thirst, and the nurse gave it a copious draught of water. Almost immediately after this, the nurse having walked away, the child must have fallen from the bank into the water. (Casper, Ger. Leich.-Oeff. vol. 1. p. 91.) The discovery of water in the stomach, except under circumstances to be presently mentioned, is not, therefore, a necessary proof that it has been swallowed during the act of drowning. (See case, *post*, page 731.)

It is of course presumed that the liquid contained within this organ is of the same nature as that in which the body is immersed; for it is possible that fresh water may be found in the stomach of a person drowned in salt water, and in such a case it would be obviously improper for a medical witness to affirm, from the mere presence of water, that the individual had died within the medium in which his body was discovered. If the water contain mud, straw, duckweed, moss, or any substances like those existing in the pond or river where the drowning occurred, this is a proof, when the inspection is recent, of its having been swallowed by a living person. In the well-known case of *Mary Ashford* (*Rex* v. *Thornton*, Warwick Summer Ass. 1817), some duckweed with about half a pint of water was found in the stomach of the deceased. The body was discovered in a pond in which duckweed was growing. This fact, notwithstanding the presence of other marks of violence, proved that the deceased must have been living when immersed.

The following case occurred at Maidstone, in July 1843. The body of a young woman was found in the Medway under circumstances that led to a strong suspicion of murder. The medical witness deposed that there were no marks of external violence, nor any sign of the deceased having struggled with the supposed murderers. There was some long grass at the back of the mouth, and in the throat. The grass was not the same as that growing on the banks of the river, but such as grew at the bottom, which the deceased had probably swallowed after having gone living into the water. On this evidence the accused was discharged. In another case investigated by Mr. Image (*Reg.* v. *Carnt*, Bury St. Edmund's Lent Assizes, 1851), the body of deceased was found with her head among water-weeds, some of which were discovered in her throat, and the finger-nails were filled with sand and mud, as if clutched convulsively. These facts aided in proving that deceased had died by drowning. The absence of water from the stomach cannot, however, lead to the inference that the person has not died by drowning, because in some instances it is not swallowed, and in others it may drain away and be lost after death.

2. *Mucous froth in the trachea and lungs.*—The interior of the windpipe in a drowned body is frequently covered by a mucous froth, and this is stated in some instances to have been so abundant as to have filled the air-tubes and their ramifications. It is sometimes disposed in a layer of minute vesicles tinged with blood. The origin of this appearance has been variously accounted for; but it is probable that it is produced by the simple agitation or admixture of the air respired during the act of drowning with the mucous secretion of the air-passages, which under these circumstances may be more copiously poured out. This mucous froth is not always met with in drowned subjects: 1. It has not been found in the bodies of those who have sunk at once below the surface. 2. The appearance may not be seen when the body has remained for a long period in the water after death, since by the free passage of this fluid into and out of the air-passages, the mucous froth, although formed in the first instance, will disappear. 3. If, after removal from the water, the body is exposed to the air for several days before it is examined, it is rare that this appearance is seen. 4. The mucous froth may have been formed in the wind-pipe, but it may have entirely disappeared, owing to the incautious manner in which the body has been handled on its removal from the water. Thus, if removed from water with the head depending, any fluid which may be contained within the lungs will escape; and in passing through the air-passages this fluid will effectually obliterate the frothy appearance. A similar appearance has been found in the bodies of those who have been hanged, or who have died from

apoplexy. The introduction of any liquid into the wind-pipe during swallowing, may produce it. A case of poisoning by laudanum is reported, in which water containing sulphuric ether was forced down the throat of a person after the power of swallowing had nearly ceased. On dissection a quantity of reddish froth was found filling up part of the trachea. Dr. Riedell looks upon the presence of this froth in the air-tubes as a constant sign of death by submersion, when the body is recently inspected. (Med. Gaz. vol. 46. p. 478.) In some cases the contents of the stomach are found in the wind-pipe and lungs. This occurs when the person has been drowned with a full stomach. Vomiting takes place, and the vomited matters are drawn into the lungs by the attempt to breathe.

Water in the lungs.—Many contradictory statements have appeared relative to the presence of water in the lungs of the drowned. It is an appearance only occasionally met with: for the glottis does not in every case of drowning become so effectually closed by spasm, as to prevent the introduction of a small portion of liquid into the air-passages. In certain cases no water is found in these passages after death, and when present, the quantity depends on many contingencies. It is commonly small, often about an ounce, but it is subject to variation, and is probably affected by the number of forced attempts at respiration made by the drowning animal. In experiments on animals, I have not remarked any difference in the quantity whether the animal was allowed to rise to the surface and respire, or whether it was maintained altogether below. There is but little doubt that the quantity may become increased after death, because it is now well known that water will penetrate into the lungs, before the access of putrefaction, when a body has been thrown in dead. It is important for a medical jurist to bear this in mind, as it may influence materially the opinion which he may be disposed to form on the discovery of water in the lungs of an apparently drowned subject. Water may therefore be present in the lungs, and yet it will afford no evidence of drowning. When the water in the lungs is mixed with *weeds* or *mud*,—and water presenting the same admixture is found in the throat and stomach, this is strong evidence that the body has been plunged into the medium when the power of breathing and swallowing still existed, and hence that the deceased has been drowned. An attention to the condition of the stomach and lungs together, will therefore be of importance in cases of alleged child-murder by drowning, since it may aid in proving or disproving the charge. In a case tried at the Central Criminal Court, April 1861, in which I was consulted by Mr. Tyte, of Harrow, some greenish-coloured mud was found in the throat, lungs, and stomach of an infant whose body had been removed from a pond. The prisoner was acquitted, because it was suggested that she might have thrown the body of her child into the water, when she believed it to be dead, and one or two gasps might have accounted for the appearances presented by the stomach and lungs!

Dr. Norman Chevers, of Calcutta, was required to examine the body of a child found in a tank at a distance from the house of the parents. The internal appearances showed that the child had died by drowning. The air-passages contained green vegetable matter, and the right air-tube was almost completely filled with so large a portion of an aquatic weed doubled together, that it appeared astonishing how such a body could have passed into the wind-pipe. It was proved that no weed of this kind grew in the tank where the body was found. Further inquiry led to the discovery, that the body of the boy had been found by a woman in a tank near his home, in which the weed found in the air-passages grew abundantly. This female conveyed the corpse to the more distant tank which belonged to a person against whom she bore a grudge! (Medical Jurisprudence for India, 1856, p. 351.) It has been suggested that water may be injected into the lungs after death, in which case an incorrect opinion might be formed from its presence, if the body were discovered on the bank of a river or canal. This, however, is an obstacle but little likely to interfere with any medical investigation. On the other hand, the absence of water from the lungs of a body found apparently drowned, must not be considered to indicate that death was not a consequence of drowning; for if the body of a drowned person be allowed after removal to remain with the head depending, the water originally contained within the air-passages will drain out: or if it be long exposed before undergoing an examination, the probability is that none will be discovered in these organs, since in the progress of time, it may disappear by imbibition and evaporation.

It may be considered that after the lapse of *five or six weeks*, especially if the body has been removed from the water for the greater part of that period, none of the usual appearances of drowning will be met with: in the present day, no practitioner would think of seeking for evidence under such circumstances.

Summary of medical evidence.—I have now reviewed the whole of the evidence which the examination of a drowned subject after death is capable of affording to a medical witness. It will be seen that the only characters met with *internally*, upon which any confidence can be placed to indicate that the person has been drowned, are the presence of water in the stomach, and the presence of a mucous froth on the lining membrane of the trachea; but at the same time, the restrictions to the admission of these signs as positive evidence of drowning, may be such as to throw great uncertainty on the correctness of a medico-legal opinion founded simply on their existence. The practitioner must then determine, before he decides positively in a question of this nature, whether there is any appearance about the person which would lead to the suspicion that death had been caused in another manner. When he has provided himself with this negative evidence, and he finds that the characters of drowning, already enumerated, are present,—or, if absent, he can, with any reasonable probability, account for their absence, he is then justified in giving a decided opinion on the subject.

A man died suddenly in the Rue St.-Antoine, at Paris, in February 1830, and the body was soon afterwards brought to the Morgue. It there underwent a minute examination; but there was no mark of violence externally, nor was there any morbid change to account for death internally. In the course of the dissection, it was found that the larynx, trachea, and air-tubes contained a frothy mucus. In the larynx this was white, but it had a red colour in the air-tubes. M. Devergie, who conducted the inspection, states, that it only differed from the froth, as it exists in the trachea of the drowned, in the circumstance of its being in larger vesicles:—but he candidly owns, that had he not been certain of the contrary, he should have presumed that he was examining the body of a person who had died by drowning. Besides this appearance, there was a large quantity of water in the stomach, amounting to almost a pint; and the lungs were gorged with blood, as in cases of asphyxia. Supposing that this body had been thrown into the river after death, it is clear that most medical men, relying upon what are usually regarded as well-marked proofs of this kind of death, would have declared this to have been a case of drowning. A practitioner could not be censured for forming such an opinion, since it would be founded upon the best ascertained rules of past experience; and there are no others by which a medical jurist can be guided. In the meantime, we learn by the occurrence of such a case, how cautious we ought to be in expressing a positive opinion in a question of this nature, even when medical circumstances exist to support it.

If, however, a case of this kind is of rare occurrence, we will take an instance of a different description. An individual may be suffocated, or may die from epilepsy, apoplexy, or from a sudden attack of any fatal disease which may not be indicated by well-marked appearances after death; the body is thrown into or falls into water, and remains there a few days. When taken out, water may be found in the lungs, but there may be none in the stomach; and there may be no mucous froth in the windpipe,—while the lungs are more or less congested; how is a practitioner to determine whether death has actually taken place within the water or not? In the case of a suffocated body, without traces of external violence, it would be impossible; since we have seen that individuals may die in the water, or at the moment of immersion, and, therefore, under circumstances in which the appearances of drowning would be either obscure or entirely wanting. Dr. Ogston, of Aberdeen, relates an instructive case of death from epilepsy, under circumstances which might have led to a strong suspicion of violent death, from the position in which a dead body was found. A man was in the act of leaving a privy, when he was seized with an epileptic fit and fell with his face in a piece of dirty water, which did not exceed a foot and a half in breadth, with a depth of from three to four inches. When discovered after death, only his mouth and nostrils and one cheek were found to have been under water. (Med. Gaz. vol. 47. p. 763.)

If, in examining a body taken from water, we discovered traces of mortal disease, or marks of external violence sufficient to destroy life, then there is always room for suspicion. Why the body of a person, who has really died from *natural causes*, should be afterwards thrown into water, it would not be easy to explain; but we can readily appreciate the motive when murderous violence has been used.

In consequence of the uncertainty attendant on the appearances of drowning, barristers have considerable advantage in cross-examining those medical witnesses who appear to support this view. Legal ingenuity is here often carried to the utmost, to show that there is no positive or well-defined *sign* of drowning; and, therefore, the inference is drawn that the deceased must have died from some other cause. It is undoubtedly true, that there is no constant or certain sign of death from drowning. The general impression among non-medical persons appears to be, that, whether in drowning or suffocation, there ought to be some particular *visible change* in the body to indicate at once the kind of death: but it need hardly be said that this notion is founded on false views; and if the reception of medical evidence on the cause of death be made to depend on the production of some such positive and visible change, then it would be better at once not to place the parties charged with the offence upon their trial, because the crime could never be proved against them. A medical inference of drowning is founded upon a certain series of facts, to each of which individually it might be easy to oppose plausible objections: but, taken together, they often furnish evidence as strong as is commonly required for proof of any other kind of death. A trial took place at the Central Criminal Court, April 1841, in which the witnesses were severely cross-examined on the appearances caused by drowning. (The *Queen* v. *Longley.*) The mother of the deceased child was charged with murder by drowning it.

When the body of the child was removed from the water, the mouth was closed: the prisoner's counsel endeavoured to make it appear that it was most usual to find the mouth *open* in cases of drowning; and then went on to say, "that the only proof of suffocation by drowning which had been adduced by the medical witness was the frothy mucus found in the air-cells;—that it could not have gone through the mouth was quite certain, because the mouth was proved to have been closed. The air might have passed into the air-cells of the child, whilst struggling in its mother's arms, just as well as whilst struggling in water!" After what has been stated, it is not necessary to point out the fallacy of the assumptions involved in this argument; but it is much to be regretted that medical evidence should be allowed to be presented to a jury in such a perverted form. The wonder is, that even in a case of undoubted criminality (as in that particular instance) a conviction should ever occur. (See also the case of the *Queen* v. *Owen*, *Thomas*, *and Ellis*, Stafford Lent Assizes, 1840.) In a case in which Mr. Image, of Bury St. Edmunds, gave evidence (*Reg.* v. *Carnt*, Suffolk Lent Assizes, 1851,) the medical facts, although furnishing conclusive evidence of drowning when taken together, were individually objected to. The deceased was found dead in a pond. The body was removed after it had been lying about four hours in the water, and was carefully examined by Mr. Image forty-one hours after death. The hair was hanging back, wet, very muddy, with leaves and weed entangled in it; the ears were muddy, the right eye ecchymosed, pupils slightly dilated, lips bluish, and there were bluish patches on the face. Slight scratches were observable on the right side of the face. The skin had a dull leaden hue. The jaws were fixed, teeth tightly clenched, and the tongue not protruding. The nails were filled with sand and mud. There were severe bruises on both arms near the elbow, equal in extent and intensity. The tongue was greatly congested, and covered with froth and mud, which extended backwards to the throat and nostrils as well as into the larynx, and trachea or windpipe, and the upper divisions of the air-tubes of the lungs. The lungs were engorged and greatly distended: when cut in any part frothy mucus was abundantly poured out, and much fluid escaped on pressure. The heart was healthy: the right and left cavities were filled with black fluid blood. There were no coagula. There were small pieces of green weed in the air-tubes (corresponding to weed in the pond). The vessels of the neck were distended with dark-coloured liquid blood, without any coagulum. The stomach was healthy; it contained partially digested food, with about a pint of liquid mixed with mud and sand. The liver was enormously congested, bleeding profusely at every section. The bladder was quite empty, and contracted to the smallest size. The sinuses of the brain were not much distended, and the substance of the organ was not greatly congested. Mr. Image gave an opinion, which was perfectly justified by these appearances, that the deceased had died by drowning, and that she had probably been held forcibly under water. The accuracy of this opinion was established by the confession of the criminal before execution.

Marks of violence on the drowned.—The chief inquiry with regard to marks of violence on the bodies of the drowned, is, whether they have resulted from accident or design. In forming an opinion, a witness must give due value to the accidents to which a body, floating loosely in water, may be exposed. Ecchymoses of considerable extent are sometimes seen on the drowned, when the bodies have been carried by a current against mechanical obstacles in a river or canal. If the deceased fell from a considerable height into water, his body in falling may have struck against a rock or projection, and have produced extensive marks of violence. Dead bodies taken out of wells, often present considerable marks of violence of a vital character, when the deceased persons have fallen in accidentally, or have thrown themselves in intentionally. The presence of these marks must not create a hasty suspicion of murder. It is manifestly impossible to lay down any specific rules for forming a decision in cases of this kind, since probably no two instances will be met with which will be perfectly similar. In clearing up these doubtful points, everything must depend on the tact and acumen of the practitioner who is called upon to conduct the investigation. The first point which he has to determine is, whether the injuries on the body were produced before or after death. (See WOUNDS, *ante*, p. 225.) If after death, then they ought to be obviously of accidental origin. Accidental violence may sometimes be of a serious nature, —so serious that a practitioner might well doubt whether it did not indicate that the deceased had been violently injured prior to submersion. If a dead body were taken out of water, with one or both extremities dislocated, or the cervical vertebræ fractured, and a surgeon was asked whether such injuries could be accidental and coincident with, or consequent on drowning, the answer would probably be in the negative; but an instance has occurred in which both arms were accidentally dislocated at the shoulders in the act of drowning. I allude to the case of a man, who, some years since, jumped from the parapet of London Bridge into the Thames. This exploit, it appears, the man had previously performed with impunity, but on this occasion he sank and was drowned. Both his arms were found dislocated, in consequence, it is presumed, of his having fallen with them in the horizontal position, instead of placing them closely to his sides. The concussion on falling into the water had sufficed to produce the accident. (Smith's For. Med. p. 228.) Here, then, we have a proof that even the mechanical resistance offered by water alone may give rise to marks of violent injury on the person. Extravasation of blood may take place into the cavities from this cause. Dr. N. Chevers has informed me that he assisted in examining the body of a sailor who fell into the water, with his head downwards; and it was found that there was an extravasation of blood in the head, beneath the arachnoid membrane.

It has been observed, with respect to superficial marks of violence, that *bruises or contusions* are not always visible on the bodies of the drowned, when they are first removed from water. This may be owing to the skin having abundantly imbibed water,—the colour of the ecchymosis being thereby concealed. After a short exposure to air, the water evaporates, and the bruise or contusion becomes visible. The great point with regard to all marks of violence on the drowned, is to throw light upon the questions: 1, whether drowning was really the cause of death; and 2, whether, if so, the act was the result of accident, suicide, or homicide. This last question does not concern a medical witness so much as the jury, who will determine it from the facts proved before them.

There is one case of rare occurrence, in which a practitioner would be apt to be misled by trusting to appearances found on the drowned. If a dead body were removed from water with a deep ecchymosed circle round the neck, evidently produced by a cord or ligature, but no traces of which could be found, it is not improbable that a suspicion would be at one raised, that the deceased had been murdered by strangulation, and the body afterwards thrown into water. An accident occurred a few years since in which a gentleman and his wife were thrown into the water by the overturning of a small boat. The lady was drowned. On an examination of the body, subsequently made, a livid circle was found round her neck, as if she had been strangled. She had evidently died by drowning, but the mark had been produced by the string of a cloak which she wore at the time of the accident. In her struggles to reach the boat, it is presumed that the tide had drifted the cloak in an opposite direction, and had thus produced the appearance of strangulation. It is not improbable that this accelerated death. Barzellotti mentions the case of a man who was drowned in the Po, while being escorted along the banks of the river, as a prisoner, by a party of soldiers. The man attempted to escape and was drowned. Besides the ordinary marks of drowning, there was a deep livid circle, extending completely round the neck, and immediately below this, another mark but paler in colour. The skin over the windpipe was ecchymosed. It was supposed that the deceased had been strangled by the soldiers and his body thrown into the water, but from the appearance of the marks, and other circumstances, Barzellotti gave it as his opinion that they had been produced by the collar of a coarse linen shirt which had been tightly buttoned around the deceased's neck,—the collar had retracted from the imbibition of water, and had thus caused the appearance of strangulation, like any other ligature. (Questioni di Medicina Legale, 1. p. 329. For another case, see Henke's Zeitschrift, 1840, vol. 1. p. 126, Erg. H.) The following case was communicated to me as having occurred during the heavy floods in the winter of 1839. A man was carried away and drowned in attempting to ford a swollen stream. When the body was found, it had been so placed by the current, that the forepart of the neck was locked against the stump of a tree, giving rise to an ecchymosed patch like that which is commonly produced by manual strangulation. [For the report of a case, in which there was much violence to the neck, see Henke's Zeitschrift, 1842, vol. 1. p. 258, Erg. H.]

It might be said that in cases of this description circumstantial evidence would commonly show how the mark had originated. In admitting the truth of this observation we must remember that circumstances, as matters of proof, do not always present themselves to our notice, or occur to our judgment, at the precise time that the law stands most in need of them. While, then, we use great caution in drawing an inference when there are such strong grounds for suspicion, we should not neglect to examine carefully the most trivial appearances. In a remarkable case of murder, in which the body of the deceased was discovered in a mill-stream, there was only one slight ecchymosed depression in the forepart of the neck, as if from a finger. The surgeon suspected from this that the deceased had been strangled. The marks of drowning in the body were wanting: and the suspicion of the real cause of death was afterwards confirmed by the confession of the criminal.

Accidental fractures in the drowned.—*Fractures* are not often met with in the drowned as the result of accident. Certain fractures likely to be followed by immediate death may forbid the supposition of their having occurred after drowning: and a careful examination of the body may show that they were not likely to have arisen from accident at or about the time of submersion. This point was raised in the case of *Reg. v. Kettleband* (Nottingham Winter Ass. 1843), where the prisoner was charged with the murder of his son, a boy aged ten years. The deceased was found dead in a pond soon after he had been seen healthy and well. An inquest was held, and as usual no inspection of the body was required by the coroner, and the jury were directed to return a verdict of "found drowned." An inspection was, however subsequently made. The neck was observed to be very loose, and on further examination the processus dentatus was found to be separated from the atlas, and the ligaments were ruptured! The three medical witnesses who gave evidence at the trial, deposed that this displacement had caused death by compressing the spinal marrow, — that the injury had occurred during life, — that it was not likely to have been caused by accident from a fall into the water, as there was no mark of a bruise about the head, and the pond was proved to be small, with a soft muddy bottom. All agreed that such an injury was not likely to have arisen from a blow or a fall under any circumstances, because it required for its production that the body should be fixed, and the head forcibly rotated on the trunk. It was in itself sufficient to account for immediate death, and it could not occur by accident after death from any other cause. Hence it was inferred,— 1, that death could not have been caused by drowning; 2, that it had resulted from the compression of the spinal marrow, by displacement of the second vertebra; and, 3rdly, that this injury must have been intentionally produced by some person. Circumstances fixed the crime on the prisoner, and the jury returned a verdict of manslaughter; although the nature of the injury, admitting that it was not the result of accident, proved that the prisoner must have acted with a most cool and deliberate intention to destroy life! This case furnishes a serious commentary on the practice of some coroners, in denying the necessity for an inspection, and in directing what is called an open verdict of "*found drowned*," when a body is taken out of water!

It is an important medico-legal question, whether fractures of the *cervical vertebræ* can occur from accident alone, about the time of drowning. In the above case, the medical witnesses had probably good reasons for denying that the injury was accidental, although such an opinion cannot always be expressed merely from the absence of marks of violence on the head. In August 1858, a gentleman in jumping from a bathing machine head foremost into water more shallow than he had expected, caused a fracture and displacement of the cervical vertebræ, which led to death. Mr. South quotes the case of a man who threw himself into a river to bathe from a height of seven or eight feet, the water being only three feet deep. He rose to the surface, but fell back senseless. When he recovered his consciousness, the account he gave of the accident was, that he felt his hands touch the bottom of the river, but to save his head drew it violently back, upon which he lost all consciousness. He died in about ten hours, and on examination the back of the neck was much ecchymosed — the interspaces of the muscles were gorged, and the vertebral canal filled with blood. The body of the fifth cervical vertebra was broken across about the middle of its depth, and the two pieces were completely separated from the lateral parts. As there was no mark of contusion or dirt on the head, Revcillon, who reports the case, believes that the fracture arose from muscular action, and not from a blow received by striking the bottom: but this is doubtful. In another instance related by Mr. South, a sailor jumped headlong into the sea to bathe, a sail being spread three feet below the surface. He immediately became motionless, and died in forty-eight hours. The fourth and fifth cervical vertebræ were found extensively fractured, and the spinal marrow was crushed and lacerated. (Chelius's Surgery, Part 6, Fractures.) In this case the fracture must have resulted from contact with the water or the sail; but as the latter was freely floating, this would be a yielding medium: hence this serious injury may occur accidentally in cases in which we might not be prepared to look for it. (For an important medico-legal case, involving many questions connected with marks of violence on the drowned, see Ann. d'Hyg. 1839, vol. 2, p. 195.)

Was drowning the result of homicide, suicide, or accident?—Although the question, whether the act of drowning was the result of suicide or murder, properly falls within the province of a jury, there are certain points in relation to it which here require to be noticed by a medical witness. In the first place, it is not to be imagined that an examination of the body will develope any differences in either of the three supposed kinds of death. So far as the phenomena of drowning are concerned, they are the same; and they are accompanied by the same appearances after death in each case. In drowning which is accidental or suicidal, it is not usual, as it has already been observed, to meet with marks of violence on the person, except such as are purely of *accidental origin*, and have commonly been produced *after death*. In accidental drowning, this is almost a constant rule: but if the individual has fallen from any height, his person may be injured in the fall either by projecting bodies on the banks of a river or canal, or by mere concussion on the water, allowance for either of which we must be prepared to make, according to the situation of the spot from which the party is supposed to have fallen.

It is calculated that drowning is the cause of death in nearly *one-half* of all suicides; but this of course will vary according to localities. In *suicidal* drowning we have a difficulty to encounter which we do not meet with in that which is *accidental*. A man may have attempted suicide by some other means, previously to precipitating himself in the water: thus, then, besides the accidental violence of accidental drowning, we may meet with violence on the person evidently indicating wilful perpetration. What is the nature of this violence? Is it to be defined? Can it always be distinguished from that which is positively *homicidal?* The answers to these questions must depend on the circumstances proved in each case.

Drowning in shallow water.—Homicide has been sometimes presumed from the peculiar circumstances under which the body has been discovered. Thus, for instance, it has been a debated question, whether a person intent on suicide can actually drown himself in *shallow* water. This question has been long since settled in the affirmative by the occurrence of some well-authenticated cases: it appears to have been raised originally on the theoretical view, that the resolution of a suicide would fail him in such a situation, and that having the means of escape, he would lose no time in extricating himself. It need hardly be stated that the mere immersion of the mouth in water not more than a few inches deep, will produce all the phenomena of death by drowning, with the exception that little or no water would probably be found in the stomach. Devergie mentions an instance which occurred in May 1833, where a man was found drowned in a small stream, his face towards the ground, and his head just covered by the water, which was not more than a *foot* in depth. On dissection, there were all the appearances of drowning present, and a large quantity of sand and gravel was found occupying the trachea and bronchial ramifications. (Op. cit. vol. 2, p. 332.) A case is mentioned by Dr. Smith, in which a woman committed suicide by breaking a hole in the ice of a pond, during the winter, and thrusting her head into the water, the rest of her body being out. In May 1837, a man was found dead near Mitcham in Surrey. He was discovered lying on his face in a small stream of water only six inches deep. The water was so shallow that it did not cover the deceased's body or his head. There was clear evidence that this was a case of suicidal drowning. In November 1855, a man was found drowned in a water-cistern, which at the time had in it only fourteen inches of water.

The discovery of bodies under these circumstances does not necessarily establish that the act was suicidal. It is quite possible that one or more assailants may hold a person's head in such a position sufficiently long to destroy life; but as the person might be capable of making resistance, we ought then to find marks of violence on the body. So, again, such a position is by no means incompatible with accidental drowning; and on this it may happen that a medical practitioner will be called to express an opinion. A man, in a state of deep intoxication, or when suddenly attacked by syncope, epilepsy, or apoplexy, may fall with his face in a gutter, ditch, or small pool of water; he may die in this position, not having the power to extricate himself (*ante*, page 732). Even marks of violence on his person must not be too hastily construed into proofs of murder. Not long since, a case of this description gave rise to a trial for murder in one of our midland counties. A man was found dead with his face in some melted snow; and there were several severe contusions on his body. The evidence showed that, after a quarrel, he had left a neighbouring inn deeply intoxicated; and it was rendered extremely probable, that he had perished accidentally on his way home. There was no reason to suppose that he had been murdered. Infants, from mere helplessness, may be drowned under similar circumstances.

Drowning from partial immersion.—There is no doubt that murder by drowning may be perpetrated without the *whole of the body* being immersed in water. A case of this kind, which was the subject of a criminal trial, was referred to me by Mr. Aldred, of Norwich, in March 1841. The case was tried at the Norwich Lent Assizes of that year (*The Queen* v. *Yaxley*), and the prisoner was convicted. It appears that the mode in which the prisoner destroyed her infant child was, by immersing its head for a few minutes in a pail of water. She removed it before it was quite dead; but it soon died, with slight convulsive motions of the limbs. The case was rendered obscure by the fact that the whole of the body had evidently not been immersed; and the only conceivable means of drowning were in a small duck-pond adjoining the house, which was covered with weeds; but no weed was found in the stomach of the child, although a quantity of water was there present. In April 1854, a case occurred in London, in which a woman was charged with causing the death of a child by drowning it. The child was found dead, with its face in a basin of dirty water. The prisoner had placed the child in this position, and had then locked the door. The death of a child under these singular circumstances is, however, quite compatible with *accident*. Mr. Tubbs has communicated to me the following case, which fell under his notice in April 1848. He was called to see a child, æt. 18 months, which was stated to be dying. On his arrival at the cottage, he found it dead: the skin was cold, and the countenance calm and pale, with the exception of a livid discoloration in the centre of each cheek. The eyelids, as well as the mouth, were half open. The pupils were largely dilated. A frothy mucus, tinged with blood, was escaping from the mouth and nostrils. The tongue was swollen, and protruded forwards. The mother of the infant, a respectable woman, gave the following account:—She was washing in one room, while the child was in an adjoining room, the door between the rooms being kept open by a pail half full of water. She went out of the house for about two minutes, and on her return she found the child with its head downwards in the pail of water, the heels and part of the body hanging over the side of the pail. She snatched it out and tried to revive it, but without effect. There was no reason to doubt the truth of her statement, and at the inquest the jury returned a verdict of accidental death. The helplessness of an infant at this age, and the rapidity with which asphyxia supervenes, sufficiently account for death under these circumstances. A case occurred in London, in 1841, in which a drunken man was drowned by falling on the bank of the Surrey Canal, with his head partly in the water, while the greater part of his body lay on the bank out of the water. It was by partial immersion that the Italian boy, Carlo Ferrari, was destroyed some years since, by *Bishop* and *Williams*, who afterwards attempted to sell the body for the purposes of dissection. The murderers first intoxicated the deceased, and then suspended him by the heels in a well, so that his mouth was but a few inches below the level of the water. A medical man, therefore, must not allow himself to be deceived respecting the cause of death on finding that the *whole* of the body has not been immersed. In this form of murder, when the inspection is recent, water, with or without weeds or other foreign matters, may be found in the ear-passages.

Ligatures on the hands and feet.—When a drowned body is removed from water with the hands and feet bound by cords, it is usually considered that we have therein strong presumptive evidence of homicide; but numerous cases are recorded in which suicides have actually bound themselves in this manner before throwing themselves into the water, probably for the express purpose of preventing any chance of their escaping death. In July 1832, the body of a full-grown man was removed from the Seine, his neck, legs, and hands being secured together by a cord furnished with slip-knots. There was no doubt that he had died by drowning, and that the act was one of deliberate suicide, the cord being so placed on his body that an individual could easily place it on himself. In this case there was no great degree of ecchymosis produced by the cord; and it was not probable that there should have been, when it was arranged by a suicide, since his object would be merely that of rendering himself helpless by securing his arms and legs. This he would doubtless accomplish without giving himself much pain. If the marks bear the evidence of violent constriction, especially on *both wrists* or on the fore part of the neck, the presumption of murder becomes strong. In a case of this kind, it would be obviously of great importance to determine whether the deceased had really died by drowning or not; since, if his death had not been due to drowning, the fact of his body, so bound, being discovered in water, would furnish the strongest possible evidence of murder. (Ann. d'Hyg. 1833, vol. 1, p. 207.)

Weights attached to the body.—If a body is taken out of water with heavy weights attached to it, the question of *accident*, as in the former case, is done away with. It must be either homicide or suicide; and doubtless many would be apt to suspect that it was a case of murder. Several instances have, however, occurred, in which persons have committed suicide by drowning, and heavy weights have been found attached on their feet and hands, or in or about the dress.

HANGING.

CHAPTER 60.

CAUSE OF DEATH. DEATH FROM THE SECONDARY EFFECTS—APPEARANCES AFTER DEATH—MARK OF THE CORD OR LIGATURE—UNECCHYMOSED MARKS—WAS DEATH CAUSED BY HANGING?—HANGING AFTER DEATH—SUMMARY OF MEDICAL EVIDENCE—MARKS OF VIOLENCE ON THE HANGED—WAS THE HANGING THE RESULT OF ACCIDENT, SUICIDE, OR HOMICIDE?—HOMICIDAL HANGING—THE POSITION OF THE BODY.

Cause of death. Asphyxia.—By hanging we are to understand that kind of death in which the body is wholly or partially suspended by the neck, and the constricting force is the weight of the body itself; while, in strangulation, the constricting force is due to some other cause. In both cases death commonly results from *asphyxia*, although this must depend in a great measure upon the position of the ligature on the neck, as well as on the degree of pressure produced. If the cord be loose, or applied to the upper part of the neck, a small quantity of air may still reach the lungs: and then the cerebral circulation may become interrupted by the compression of the great vessels of the neck. In this case apoplexy of the congestive kind is induced, and operates as the immediate cause of death. It is easy to conceive that there may be a mixed condition of asphyxia and apoplexy, and according to the observations of Professors Casper and Remer this is actually met with in a great number of instances. The following tables represent the results at which they have arrived from the examination of a large number of cases:—

	Remer.	Casper.
Apoplexy	9	9
Asphyxia	6	14
Mixed conditions	68	62
Total	83	85

It has been observed in the execution of criminals, that death does not always ensue within the same period of time; and we may probably best explain this fact by a reference to the greater or less degree of constriction produced by the ligature. If the rope should press upon the larynx or above this organ, the occlusion of the air passages will not be so complete as if it pressed upon the trachea immediately below the cricoid cartilage. A slight degree of respiration might, in the former case, continue for a short interval, by which the life of a person would be prolonged; while in the latter, death would be immediate. If the trachea be in part ossified, the pressure of the cord is less perfect, and death will then take place more slowly. It has been supposed that the immediate cause of the stoppage of respiration was a pressure produced by the cord on the nerves of the neck; but it must be considered as very improbable that, under the circumstances in which hanging generally takes place, the cord should exert any pressure on the nerves sufficient to produce death. In the greater number of cases of suicidal hanging, which are commonly unattended with much violence, the pressure on these nerves cannot obviously exist; and in violent hanging, the projection of the anterior parts of the neck must suffice to prevent these slender nervous filaments from becoming exposed to such a degree of compression as directly to impede the exercise of their functions.

There is an occasional cause of death in hanging, which appears to have been first brought to the notice of the profession by Louis. Having remarked that, in public executions, death sometimes took place with great rapidity, and in other cases more slowly, he was led to inquire into the circumstances. He found that in the cases of rapid death, the executioner was in the habit of giving a violent rotatory motion to the body of the criminal at the moment it was turned off, whereby a displacement of the dentiform process of the second cervical vetebra took place, so that the spinal marrow became suddenly compressed. This cause of death must be extremely rare: as a general rule it is only likely to be observed in corpulent or heavy subjects, when a long fall is given to the cord, and when much violence has been at the same time employed by the executioner. It is seldom met with in persons criminally executed; and in cases of suicidal hanging it is so rare, that Devergie found the ligaments between the first and second cervical vertebræ ruptured only once in fifty-two cases. M. de la Fosse considers, from the observations which he has made on the subject, that, in violent hanging, the dentiform process of the second cervical vertebra is much more likely to be fractured than to become displaced, and he found this in the case of an executed criminal. On an examination of the body, he discovered that the two first cervical vertebræ had been completely separated from the remainder of the spinal column by the rupture of the intervertebral substance, and that they were firmly attached by their ligaments to the occipital bone. The dentiform process and body of the second vertebra were detached from the bony ring, but were still connected as usual with the anterior arch of the atlas. The spinal marrow had become compressed by the fractured portions of the vertebræ. Probably further observations may show that the injury to the spine is not always of the same nature, and that fractures of the vertebræ are really more frequent than simple luxations of the dentiform process: in the mean time, we must admit that such severe injuries may occur in hanging, and that when they do occur, death must be very sudden. But death may proceed from mere effusion of blood on the spinal membranes (sheath), thereby giving rise to fatal compression. This is likely to happen when the head falls, or is bent suddenly backwards, so that the weight of the body is supported on the back of the neck. See a case of this kind by Mr. Campbell de Morgan (*post*, p. 763). Death from hanging appears to take place very rapidly, and without causing any suffering to the individual.

Death from the secondary effects.—It by no means follows that because we have succeeded in restoring the respiratory process, the person is safe. Death often takes place by a fatal relapse at various periods after the accident. A case of this description has been published by Sir B. Brodie. A boy, æt. 17, was found hanging. When cut down he was insensible, his face livid, his lips were of a dark purple colour, pulse not perceptible, pupils dilated and motionless. Artificial respiration was used, and in a quarter of an hour the diaphragm began to act. He breathed at irregular intervals with stertor, and with a rattling noise in the throat. The pulse became perceptible but often flagging, and the surface of the body was cold. The countenance was still livid, but the pulse and breathing improved. At the end of another hour an attempt was unsuccessfully made to take some blood from the arm, and the patient was placed in a warm bath. The breathing was stertorous through the night, and in the morning twelve ounces of blood were taken from the arm; but there was no relief. He continued insensible, and cold on the surface: there was frothing at the mouth, and he died twenty-four hours after he was cut down. The body was carefully examined. The vessels of the brain were very full of blood: this was the only morbid appearance. In another instance, a labouring man who had hanged himself, was cut down in a state of insensibility. He lay for a considerable time breathing with apoplectic stertor, but eventually recovered. (Lectures on Pathology, 72.) Dr. Shearman has reported in the Lancet (Jan. 6, 1844) a case in which a powerful athletic man, who had been committed to prison for theft, hung himself. He was found apparently dead, hanging by his own handkerchief. He was cut down, and seen by Dr. S. half an hour after the occurrence. The man was then apparently lifeless; he neither breathed nor moved, nor had any perceptible circulation. The face and neck were much swollen and livid, and the ecchymosed mark of the cord was immediately below the thyroid cartilage: the fingers were bent, and the hands nearly clenched. His head was raised, the windows were thrown open, and blood abstracted from the arm, which was put into hot water in order to increase the flow. In a few minutes the man began to breathe:—the bleeding was allowed to continue until the pulse was felt at the wrist, and the pupil contracted completely on the application of a lighted candle. The breathing was stertorous. Brandy and water were injected into the stomach, and warmth was applied to the extremities. In the course of a few hours he rallied very much; his pulse had become firmer and quicker (130), his head was hot; he was restless, unmanageable, and violently convulsed in the arms and legs. Shortly before death he was calm, and spoke several times. He suddenly became exhausted, and died nineteen hours after he was found hanging. This was probably a mixed case of asphyxia and apoplexy. The medical treatment appears to have been proper. The unsuccessful result may perhaps be ascribed to the injury sustained by the cerebral circulation from constriction of the neck. In hanging as well as in drowning, therefore, a person may in the first instance recover, but subsequently die in spite of the best medical treatment, probably from the depressing effects produced on the nervous and muscular systems by the circulation of dark-coloured blood. A case in illustration of this point has been reported by Dr. B. W. Richardson. (Med. Times and Gaz. Dec. 17, 1853, p. 639.) The man died on the second day after he was cut down. On inspection, the brain was found greatly congested, and there was effusion of serum under the (arachnoid) membrane. The lungs and heart were congested, and a solid fibrinous deposit was found in the right ventricle.

Appearances after death.—The following *external* characters of the body are laid down as indicative of hanging by most medico-legal writers. Lividity and swelling of the face, especially of the lips, which appear distorted;—the eyelids are swollen, and of a bluish colour—the eyes red, projecting forwards, and sometimes partially forced out of the orbitar cavities;—the tongue enlarged, livid, and either compressed between the teeth or frequently protruded:—the lower jaw is retracted, and a sanguineous froth sometimes exists about the lips and nostrils. There is a deep and ecchymosed impression around the neck, indicating the course of the cord, the skin being occasionally excoriated;—laceration of the muscles and ligaments in the hyoideal region;—laceration or contusion of the larynx, or of the upper part of the trachea. There are also, commonly, circumscribed patches of ecchymosis varying in extent, about the upper part of the trunk and the upper and lower extremities, with a deep livid discoloration of the hands. The fingers are generally much contracted or firmly clenched, and the hands and nails are livid. The urine and fæces are sometimes involuntarily expelled at the moment of death. Internally, we meet with the appearances described under the head of asphyxia, i. e. engorgement of the lungs and venous system generally, with dark-coloured blood. The right side of the heart, and the great vessels connected with it, are also commonly distended with blood. But when the inspection has been delayed for several days, this distension may not always be observed. The mucous membrane of the windpipe is more or less congested, and is sometimes covered with a bloody mucous froth. This may be owing to imperfectly obstructed respiration, and spasmodic efforts at breathing. The vessels of the brain are commonly found congested; and in some rare instances, it is said extravasation of blood has been met with on the membranes and in the substance of the organ. Extravasation of blood is, however, so rare, that Remer found this appearance described only once among one hundred and one cases: and in one hundred and six cases, recorded by Casper, it was not found in a single instance. In one case of death from hanging, Sir B. Brodie found a large effusion of blood in the substance of the brain; and he refers to another case, in which there was a considerable effusion between the membranes. (Lectures on Pathology, 58.) The venous congestion of the cerebral vessels is rarely greater than in other cases of asphyxia, and is probably dependent on the degree in which the lungs have become engorged. In most instances there is increased redness of the substance of the brain, so that, on making a section of the hemispheres, a greater number of bloody points than usual will appear. The kidneys have been found much congested. A more important circumstance has been noticed by Dr. Yelloly, namely, that in examining the stomachs of five criminals who had been hanged, he found great congestion in all; while there was blood coagulated upon the mucous membrane in two. Such an appearance might, it is obvious, be attributed in a suspicious case to the action of some irritant substance. (See Ann. d'Hyg. 1830, p. 166; 1835, p. 208; 1838, p. 471.) In the case of *Good*, who was executed for murder a few years since, the stomach was found on inspection to present over its whole surface a well-marked redness, resembling the effect produced by an irritant poison. The redness was especially observed at the pyloric end, where it assumed a somewhat striated character. A drawing representing the appearance of the interior of the stomach is preserved in the Museum Collection of Guy's Hospital. In a case examined by Mr. Stuart, of Azimghur, in 1854, the stomach and intestines, especially the inner coat of the former, were much congested and inflamed, as if the man had died from poisoning. The contents of the stomach were analyzed, but no poison found. Dr. Chevers, who quotes this case, states that he has more than once verified Dr. Yelloly's observation, and has found the mucous membrane of the stomach much congested in death from hanging. (Medical Jurisprudence for India, p. 397.)

The *external* appearances have been chiefly derived from the examination of the bodies of executed criminals. Such well-marked characters are not generally met with in cases of *suicidal* hanging; and therefore it will be proper to state what are the principal differences. Thus, the face is sometimes pale,—a condition commonly seen in those cases in which there has been but little obstruction to the cerebral circulation, either from the softness or looseness of the ligature. Esquirol found in one instance, that when the body was examined immediately after death, the face was not livid; but it first began to assume a violet hue in eight or ten hours. He thought that when the cord was left round the neck the face would be livid; but, if removed immediately after suspension, pale. This view is not, however, borne out by observation. The tongue is not always protruded. Devergie found that there was protrusion of this organ only in eleven cases out of twenty-seven. This protrusion was formerly supposed to depend upon the position of the ligature:—thus it was said when this was below the cricoid cartilage the whole of the larynx was drawn upwards, and the tongue carried forwards with it; while, when above the os hyoides, the tongue was drawn backwards. The protrusion or non-protrusion of the tongue does not depend upon any mechanical effect of this kind, but simply upon congestion; for it is occasionally met with thus protruding in cases of drowning and in other forms of asphyxia. Besides, the protrusion has not been found to have any direct relation to the position of the ligature.

There is another appearance on which a remark may be made, namely, the state of the hands. As a general rule, in violent hanging or strangulation, the hands are clenched. This appearance may not always be found, as it may exist and be destroyed before the body undergoes medical inspection. When the constriction on the neck is produced suddenly and with great violence, we may expect to meet with this appearance. Thus it is found in the cases of executed criminals, and in strangulation attended with great violence (see case by Mr. Rake, *post*, p. 767), whether the act be due to homicide or suicide. In cases in which the constriction is gradually produced, the clenched state of the hands may not be found. (Cases by Mr. Beeke, *post*, p. 767.) Convulsions generally attend violent hanging or strangulation. The influence of these on the attitude or dress may not be apparent, unless the body be sitting or lying.

Mark of the cord or ligature.—The most striking external appearance, however, is the *mark* produced on the neck by the ligature. The skin is commonly depressed, and sometimes ecchymosed, but rarely throughout its whole extent; it is very frequently free from all traces of ecchymosis, the skin in the depression being then hard, brown, or of a *parchment colour* and consistency; or there may be only a thin line of ecchymosis in the upper or lower border of the depression. The course of the mark is generally oblique, being lower in the fore part than behind; and it is often interrupted. If the noose should happen to be in front, the mark may be circular, the jaw preventing the ligature from rising upwards in the same degree before as it commonly does behind. The mark is generally single; but we may meet with it double, as where the ligature has been formed into two circles or loops previously to its application. Its other characters will depend upon the nature of the ligature employed. Thus a large and wide ligature rarely produces ecchymosis.—the mark is wide and superficial; but a small ligature produces a narrow and deep impression, sometimes accompanied with laceration of the cuticle and effusion beneath the skin. From the statistical returns of Devergie and Casper, it would appear that a cord or rope is employed in more than one half of all the cases of hanging which occur. In other instances various articles of dress were found to have been employed.

Medical jurists have considered it proper to examine into the position of the ligature, as this may sometimes form a question in cases of suspected murder by hanging. The following table will show that in more than two-thirds of all cases of *suicidal* hanging, the ligature is found encircling the neck between the chin and os hyoides.

	Remer.	Devergie.	Casper.
Above the larynx	38	20	59
On the larynx	7	7	9
Below the larynx	2	1	0
	47	28	68

Unecchymosed marks or depressions.—It was formerly believed that the impression produced by the cord was invariably ecchymosed, but more correct observation has shown that this is probably an exception to the general rule. When ecchymosis does exist, it is commonly superficial and of slight extent. There is rarely, if ever, effusion of blood in the cellular tissue. Dr. Riecke, of Stuttgard, in his observations on hanging, found only once in thirty cases an extravasation of blood beneath or on both sides of the depression produced by the ligature. The tongue was generally between the teeth, and in most cases wounded by them. He attributed death to stretching of the spinal marrow. (Henke's Zeitschrift, 1840, 27 Erg. H. 332.) In the bodies of individuals who have been criminally executed it is not unusual to find ecchymosis; but even here it is not always present. In a case which I had an opportunity of examining some years since, there was only a slight trace of ecchymosis in one spot where the knot in the cord had produced contusion. That it should commonly occur in criminal executions is not surprising considering the violence employed on these occasions; but it has been somewhat too hastily assumed that these appearances in executed criminals are met with in all cases of death from hanging. Dr. Croker King, in examining the neck of an executed criminal, did not discover the smallest effusion of blood in the course of the cord, although in this case the body of the criminal was allowed to fall from a height of seven feet and a half, with a fearful jerk. (Dublin Quarterly Journal, No. 35, Aug. 1854, p. 86; and Cases of Ruptured Intestine, 1855, p. 12.) The theory of the production of ecchymosis has been carried so far, that a *livid mark* in the course of the cord has been pronounced to be the best criterion for distinguishing hanging in the living from hanging in the dead body! It will be seen, however, that no reliance can be placed on this appearance. In fifteen cases examined by M. Klein, in twelve examined by M. Esquirol, and in twenty-five cases of suicidal hanging which occurred to M. Devergie (Op. cit. vol. 2, p. 394), there was no ecchymosis whatever in the course of the ligature. (Annales d'Hyg. 1832, p. 413; 1842, p. 146.) Out of six cases, Fleichmann met with only one instance. In three cases of suicidal hanging which I have had an opportunity of examining, no ecchymosis had been produced by the ligature. In all of these instances, the skin, instead of being blue or livid, or presenting effusion of blood in the cellular tissue beneath, was hard and of a *yellow colour*, resembling parchment. It had that appearance which the cutis commonly assumes when the cuticle has been removed from it two or three days; and, on dissecting it off, the cellular membrane beneath often appears condensed and of a silvery whiteness. Dr. Chevers states that he has not met with any ecchymosis in the skin along the course of the mark. (Op. cit. p. 406.) In some instances the mark, instead of being livid or brown, has presented itself simply as a white depression. This has been chiefly observed in fat subjects. The observations of Casper on this point are as follows: — Out of seventy-one cases, there was no ecchymosis produced by the cord in fifty; and thus in two-thirds of the cases examined it was entirely absent. Casper also found that there was no difference in the result, whether the ligature was removed sooner or later after death. Remer considers ecchymosis in the course of the cord to be a frequent appearance in hanging; but Devergie properly objects to the inference which he has drawn from his cases. (Op. cit. vol. 2, p. 397.)

The following singular case, which occurred to Dr. Hinze, of Waldenburg, will show that the presence of ecchymosis in the mark does not depend, as Esquirol supposed, on the ligature being left around the neck. A young man in a fit of drunkenness hung himself with a stout cord. In about half an hour afterwards, he was cut down, and attempts were made to resuscitate him. It was perceived that the cord had merely produced a superficial impression on the neck, destitute of any appearance of ecchymosis. Signs of returning life began to manifest themselves: the attempts at resuscitation were continued for several hours, but all signs of vital reaction disappeared: and now, when life was about to become again extinct, to the astonishment of those present, the mark on the neck, which had been hitherto colourless, became deeply ecchymosed. On an inspection being made the next day, it was found that this ecchymosis continued: and that it was owing to a real subcutaneous effusion. From the appearances in the head, it was concluded that the deceased had died from congestive apoplexy.

Injuries to the muscles and deep-seated parts of the neck are, of course, only likely to be seen when considerable violence has been used in hanging. In one or two instances, the lining membrane of the common carotid artery has been found lacerated. Congestion and tumefaction of the genital organs in both sexes have been set down among the common consequences of hanging,—but many observers have not met with these conditions; and it is doubtful whether, unless the body be examined speedily after suspension, any marked difference would be discovered. A more common sign, perhaps, is the discharge of the spermatic secretion in the male, but according to Casper, it is the mucous secretion of the prostate gland which is thus discharged at the moment at which death takes place. He states that traces of this are met with in from one-third to one-fourth of all cases of death from hanging in the male. It appears to me that little reliance can be placed upon evidence derivable from this appearance, and yet it has sufficed to give rise to a most violent controversy among French medical jurists. (Annales d'Hygiène, 1839, vol. 1, pp. 169, 467: vol. 2, 393; 1840, vol. 2, p. 314.) It is I think clear that unless death from hanging be strongly established by other facts, neither the examination of the linen of the deceased nor the application of the microscope to the mucous fluid found in the urethra, would be of any practical value in elucidating the question,—at least to the satisfaction of an English jury. M. Donné justly considers evidence of this kind to be a piece of scientific refinement, in which, by attempting to prove too much, we prove nothing. Spermatic fluid may be found in the urethra of a person who has died from natural causes: and Donné has ascertained that the ejaculation of a portion of this fluid into the urethra may even take place in a subject hanged up after death. He has found the fluid in some of these cases to contain living spermatozoa. (Cours de Microscopie, p. 303.) For some remarks on the relative frequency of these appearances, by M. Brierre de Boismont, see Med. Gaz. vol. 44, p. 84.

The following may be regarded as a summary of the appearances in death from hanging, when death has really taken place from asphyxia. The countenance is livid, or sometimes pale, the eyes are prominent, the tongue congested and occasionally protruded, the lower jaw retracted:—the skin is covered with patches of cadaveric ecchymosis, the hands are livid and clenched,—an oblique mark is found on the neck,—sometimes presenting traces of ecchymosis: commonly, however, the skin is only brown in colour and hardened. The larynx, trachea, and subjacent muscles are lacerated, depressed, or discoloured. The vessels of the brain are congested, as well as those of the lungs, and the right cavities of the heart. A mucous froth is occasionally found in the trachea. These appearances will of course be modified, or they may be altogether absent, when death has taken place from disorder of the cerebral circulation, or from injury to the spinal marrow, either by effusion of blood, fracture, or displacement.

Was death caused by hanging?—When a person is found dead and the body suspended, it may be a question whether death really took place from hanging or not. In investigating a case of this kind, it is necessary to draw a distinction between the *external* and *internal* appearances of the body. The former alone can assist us in returning an answer to this question:—the internal appearances of the body can furnish only the general signs of asphyxia, and enable us to say whether any latent cause of death existed or not. The microscopical examination of the blood as contained in the vessels above and below the seat of constriction, has failed to throw any light upon this question. (See Med. Gaz. vol. 38, p. 1042.) Neither the state of the countenance or skin, nor the position of the tongue, can afford any evidence on the subject of death from hanging.

Evidence from the mark of the cord.—Among the external appearances it is chiefly to the *mark* produced by the cord on the neck, that medical jurists have looked for the determination of this question. As the form, position, and other characters of this mark have been already described, it will now be only necessary to allude to it, as furnishing evidence of life at the time of its production. It has been stated, that so far from being constantly livid or ecchymosed, this condition is, in reality, not seen in more than one-half of the cases which occur. But admitting that we find ecchymosis in the course of the ligature, are we always to infer that this must have been applied while the person was living? The case which occurred to Dr. Hinze (p. 749) proves that the presence of active life is not necessary for the production of an ecchymosis in the mark: and from the experiments of Devergie, it would appear that if a subject be hanged immediately or a short time *after death*, an ecchymosed mark may be produced by the application of a ligature to the neck. (Op. cit. vol. 2, p. 408.) If a few hours were suffered to elapse, so that the body had become cold before suspension, no ecchymosis was produced by the ligature. Professor Vrolik, of Amsterdam, found, however, that a slightly livid mark was produced on the neck of a dead body, which had been suspended *an hour* after death. (Casper, Woch. Feb. 1838.) Hence this condition of the mark in a body found dead, merely indicates either that the deceased must have been hanged while living, or very soon after the breath had left his body. It would be for a jury to decide between these two assumptions; and to consider why, when a man had really died from other causes, he should have been hanged in secrecy immediately after death. (See Ann. d'Hyg. 1842, vol. 1, p. 134.) The circumstance that an ecchymosed mark may be produced by suspending a recently dead body, bears out the statement of Merzdorff—that it would be in the highest degree difficult, if not utterly impossible, to determine medically, from an inspection, whether a man had been hanged while living, or whether he had been first suffocated, and hanged up immediately after death. In making this admission it is proper to bear in mind, that that which is difficult to a conscientious medical jurist, is often very easily decided by a jury from the general evidence afforded to them.

Sometimes, besides ecchymosis, there are excoriations of the skin in the course of the cord, and these are known to have been produced during life by the effusion of blood which accompanies them. Devergie never met with this appearance in the dead body even when the hanging took place immediately after death. The discovery of effused coagula in or about the spinal column would render it probable that the deceased must have been hanged while living. Such marks of violence are, however, rare in cases of hanging: and when they are found, it might be assumed that the effusion and coagulation of blood had been caused by violence offered to the neck *immediately after death*; but this assumption may be met by the question already suggested, namely, why death by hanging should be simulated in the body of a person who was alleged to have died from another cause!

With regard to the other, or more common kind of mark in suicidal hanging, it can scarcely be said to furnish any evidence in relation to the question which we are here considering. The depression may be hard and brown, although it does not usually acquire this colour until some hours have elapsed after death; for it appears to depend simply upon a desiccation of that portion of the skin which has been compressed by the ligature. Sometimes the upper and lower borders only of the depression present a faint line of redness or lividity; and it is worthy of remark, that when the ligature presents any knots or irregularities, those portions of skin which sustain the greatest compression are white, while those which are uncompressed may be found more or less ecchymosed. It is in this manner that the form of the ligature is sometimes accurately brought out. It may be remarked of these depressions produced by the cord, that the characters which they present are the same, whether the hanging has taken place during life or soon after death:—the appearances may be similar in the two cases.

Effects of hanging on the dead body.—The following are the results of some experiments performed by Casper:—1. The body of a man aged twenty-eight, was suspended an hour after death, by a double cord passed round the neck above the larynx. It was cut down, and examined twenty-four hours afterwards. Between the larynx and os hyoides, there were two parallel depressions about a quarter of an inch deep—the skin having a brown colour with a slight tinge of blue, and a leathery consistency: in certain parts it was slightly excoriated. There was no extravasation of blood beneath, but the muscles which had undergone compression were of a dark purple colour, and the blood-vessels of the neck were congested. The appearance of this subject was such, that any individual unacquainted with the facts would have supposed, on looking at it, that the person had really been hanged while living. There was nothing to indicate that the hanging had taken place an hour after death. 2. The body of another young man was hanged an hour after death, and an examination was made the following day. The two depressions produced by the double cord were of a yellowish brown colour, without ecchymosis. The skin appeared as if it had been burnt or cut, and felt like parchment. 3. The body of an old man who had died from dropsy, was hanged *two hours* after death. The impressions presented exactly the same characters as in the preceding case. (Wochenschrift für die G. H. January, 1837.) When the constriction took place at a later period after death, there was no particular effect produced.

We learn from these experiments, as well as from those performed by other observers, that the mark which is usually seen on the neck in hanging during life (non-ecchymosed), may be also produced by a ligature applied to the neck of a subject *within two hours* after death,—consequently the presence of this mark on the neck is no criterion whether the hanging took place during life or after death. The changes in the skin beneath the mark are also destitute of any distinctive characters: there is the same condensation of the cellular membrane whether the hanging has occurred in the living or dead. These changes are the simple result of a physical cause,—mechanical compression.

Summary of medical evidence.—From the foregoing considerations, we draw the conclusion that there is no distinctive sign by which the hanging of a *living* person can be determined from an inspection of the dead body. All the external marks may be simulated in the *dead* subject, and the internal appearances furnish no evidence whatever. Still, when the greater number of the signs enumerated are present, and there is no other satisfactory cause to account for death, we have strong reason to presume that the deceased has died from hanging. We must not, however, abandon medical evidence on these occasions, merely because plausible objections may be taken to isolated portions of it. Facts may show that, however valid such objections may be in the abstract, they are wholly inapplicable to the particular case under investigation. Perhaps the greatest medical difficulties occur in reference to cases of *suicide*, owing to the slight appearances which attend this form of death: but on these occasions, moral and circumstantial proofs are so generally forthcoming, that even an inspection of the body is scarcely ever deemed necessary by a coroner! If, then, it be admitted by a medical jurist, that it is not in all cases possible to distinguish hanging in the living from hanging in the dead body, the admission must be considered as having reference to cases wherein individuals destroy themselves, and not to cases in which they are destroyed by others. Even if a doubt were raised in any particular instance, it is more than probable that circumstantial evidence would furnish data for a decision, and thus satisfactorily make up for the want of ordinary medico-legal proofs. If when we found a deeply ecchymosed mark around the neck of a dead subject, we said, all other circumstances being equal, that the individual had most probably died by hanging, we should not be departing from a proper discharge of our duty; since although it is medically possible that such a mark may be produced after death, yet as it would be only a murderer who would think of hanging up a recently dead body to simulate suicide, so it is certain, that in such a case we should most probably find some obvious indications of another kind of violent death about the person. The absence of these, and the presence of ecchymosis in the course of the cord, would, it appears to me, leave the question of vital hanging decidedly settled in the affirmative. It is necessary that great caution should be used in expressing an opinion that the hanging probably took place after death, merely from the absence of ecchymosis in the seat of the ligature; because, while this is generally true, it may in particular cases lead to the concealment of the real mode of death. Many facts already adduced show that numerous cases of hanging during life would be pronounced to be cases of hanging after death, if this were taken as a criterion. The mere discovery of violence about the person is not of itself sufficient to rebut the presumption of death from hanging on these occasions. The violence should at least be of such a nature as to account for the immediate destruction of life, or it can throw no light upon the question whether the individual might not have died from hanging, in spite of the marks of maltreatment found upon the body.

If, in the case of a person found hanging, a medical jurist should assert that death had *not* taken place from this cause, this would be tantamount to declaring that the deceased must have been murdered:—because it is difficult to believe that any but a murderer would hang up a recently dead person. This hanging after death has been frequently carried out with the view of concealing the real mode of death, and of making the act appear to be one of suicide. The following case is reported by Deveaux. A female was found suspended to a beam in a barn. Owing to the absence of all the usual marks of hanging about the face and neck of the deceased, a careful examination of the body was made. In the course of the inspection, a small penetrating wound evidently inflicted by a round instrument, was discovered on the right side of the chest, but in great part concealed by the breast of that side. On tracing the wound, it was found to pass between the fifth and sixth ribs, completely perforating the heart from the right to the left side. A considerable extravasation of blood had taken place internally, which had been the cause of death. It was therefore evident from the result of this examination, that the deceased had been killed, and her body suspended after death. (For a precisely similar case by Prof. Vrolik, see Casper, Woch. Feb. 1838.) Fodéré refers to a case in which an individual was found hanging under somewhat similar circumstances, and on examination it was discovered that death had been caused by the administration of poison,—the body having been subsequently suspended. In one instance Devergie discovered a quantity of plaster of Paris in the stomach and intestines of a person found hanging. There are, however, cases in which some embarrassment may occasionally arise. It may be a question whether the discovery of poison in the body of a person found hanging is consistent with a previous attempt at suicide by poison. An individual has even been known to hang himself after or about the time that he had swallowed a strong dose of prussic acid.

Marks of violence on the hanged.—The presence of marks of violence on the body of a hanged person is important; and it will be proper for a witness to notice accurately their situation, extent, and direction. Having satisfied himself that they must have been received during life, he will have to consider the probability of their being of accidental origin or not. These marks of violence are not always to be regarded as furnishing unequivocal proofs of murder; for it is possible that they may have been inflicted by the individual himself before hanging, and not succeeding in committing suicide by these attempts, he may subsequently have resolved to accomplish his purpose by suspending himself. Let the witness duly reflect on these circumstances before he allows his opinion to implicate any party, —let him consider that a hanged subject may bear the marks of a gun-shot wound, his throat may be cut, his person lacerated or disfigured, and yet, before a suspicion of homicide is allowed to be entertained, it ought to be clearly shown that such injuries could not, by any probability, have been self-inflicted. The importance of observing caution in such a case will be still more manifest, when there is no ecchymosis produced by the cord, and the face does not present the usual characters of hanging. Marks of violence on a hanged subject may in some cases be fairly ascribed to *accident*. If the individual has precipitated himself with any violence from a chair or table in a furnished apartment, he may have fallen against articles of furniture, and thus may have given rise to lacerations and contusions, especially on the extremities. Again, it is possible to imagine that the rope may have given way, and the individual, in falling, have injured his person; but he may afterwards have had resolution enough to suspend himself again. Such an occurrence may be rare; but when the presence of these injuries is made to form the chief ground of accusation against a party as the murderer, their accidental origin ought not to be lost sight of by a considerate witness. If we suppose the person to have been hanged in a state of intoxication or stupefaction, medical evidence alone will rarely suffice to determine the question of homicide or suicide. The absence of all marks of violence from the body might actually lull suspicion. It is proper on these occasions to look to the hands of the deceased, since it is with these that a person defends himself: and unless taken unawares, it is almost certain, if the hanging were homicidal, that there would be traces of violence on these parts. The clothes would be torn and discomposed, and the whole appearance of the deceased would be that of one who had done his utmost to resist a violent murderous attack. There are some injuries which could not be attributed to accident under the circumstances. Among these we may enumerate fractures, dislocations, deeply penetrating incised and gun-shot wounds. Now the question is, Do these serious injuries necessarily establish homicide? The answer must be in the negative: although when fractures or dislocations exist, there are very strong grounds for suspicion.

Suicides, it must be remembered, are capable of making many attempts on their lives by various means. In the spring of 1836, a gentleman was found dead, hanging in his bed-room at an inn. His dress was much disordered; and blood, which had issued from a deep wound in the throat, was found scattered over the floor. From the facts proved, there was no doubt that this had been an act of suicide: and that the deceased, previously to hanging himself, had first attempted to cut his throat. Had his body been found in an exposed situation, this wound in the throat might have given rise to a suspicion of murder. The following somewhat remarkable case occurred at Walworth in 1836. A young man was found hanging in his bed-room, quite dead. He was suspended by his cravat, and his feet were within an inch of the floor. The door of the room was fastened on the inside, and it was proved that no one could have had access to it. An earthen pan was found near the bed, containing about a pint of blood, which appeared to have issued from a very deep incision in the bend of the left arm of the deceased. The razor with which this had been inflicted was found on the mantelpiece. It came out in evidence that on the night previously, the deceased had swallowed a quantity of arsenic, and had suffered severely from the effects of the poison; although at the time it was supposed that his illness was due to other causes. In this case there were three modes by which suicide was attempted. The deceased had first taken poison, then wounded, and afterwards hanged himself. There could be no doubt that death was caused by hanging; and had the wound been inflicted, and the poison administered by other parties, this opinion might have been safely expressed. Had the body been found hanging in a suspicious locality, these circumstances would have created a strong presumption of murder.

The following case is reported by M. Dégranges:—A man was found hanging in a room by a cord attached to a nail in the ceiling. In the upper and fore part of his neck there was a deep wound, through which the cord had passed. A ladder was placed against the wall by the side of the body. About a pound of coagulated blood was found on the floor, as well as in different parts of the apartment; and some linen, covered with blood, was discovered near the body. In the table-drawer, in the apartment above, was found some cord sprinkled with blood, as if a bloody hand had been searching in it. On the staircase between the two apartments there was no trace of blood. The deceased's apartment was secured on the inside by the door being bolted. An opinion was demanded of the reporter respecting the manner in which the deceased had died, and the probability of his having been murdered. The deceased's clothes were spotted with blood, and his hands were also bloody. The body externally did not present the *slightest* trace of any ecchymosis or other mark of violence. The hands were likewise free from violence; the fingers contracted, and the nails blue. There were patches of cadaveric lividity scattered over the trunk; and it was evident that the fæces had been discharged. The face had a slight violet tint, and the tongue projected about an inch from the mouth. This organ had been forcibly compressed by the teeth. The wound in the throat was situated between the chin and os hyoides (bone of the tongue) and extended from the angle of the jaw on one side to the opposite angle. It had penetrated through the cavity of the mouth to the pharynx, but had only divided some small branches of the thyroideal artery: it had evidently been inflicted after several attempts, for its edges were irregularly cut. The cord, in passing through the wound, had lacerated, and extended it at the two extremities. The cerebral vessels were filled with blood; the cervical vertebræ were uninjured and the stomach was free from any trace of poison. The opinion given from these data was to the effect that the deceased had died from hanging, and that he had hanged himself.

When we consider that in this case the deceased had laid open his throat as far as the vertebral column, dividing the right superior thyroideal artery, by which so much blood had been lost that it was not unlikely he would have soon fallen into a state of syncope, it is remarkable that he should have had sufficient presence of mind and muscular power to have done what the evidence shows he *must* have done, namely, to have placed a handkerchief on his wound in order to arrest the hæmorrhage; to have gone up-stairs to another room, and have searched in a table drawer for the cord with which he intended to hang himself; to have placed a ladder against a wall, and to have made use of this for the purpose of fixing a cord to a nail in the ceiling, an act which could only have been performed with great difficulty. When we duly reflect on all these circumstances, it does not appear extraordinary that the magistrate who ordered the examination should have been prepared to receive an account of the deceased having been murdered. Much, it is true, rested upon the moral and circumstantial proofs: as, for example, on the previous state of mind of the deceased, and the fact of his room having been found secured on the inside. Casper mentions a case in which a woman was found hanging in her room. On examining the body, two penetrating wounds were seen on the left side of the chest. These had perforated the pericardium, and touched the surface of the heart, without entering its cavities. There was a basin of bloody water and a bloody sponge on the table; the right hand of deceased was stained with dried blood, and the door and window were fastened on the inside. There was no doubt that this was a case of suicide, and that, after inflicting the wounds, the deceased had suspended herself. The mark on the neck was nowhere ecchymosed, but of a yellowish or parchment colour. There was nothing in the nature of the wound to have prevented self-suspension. (Ger. Leich.-Oeffn. vol. 2. p. 89.)

The remarks made relative to incised wounds will apply to gun shot wounds. A suicide may attempt to destroy himself with a pistol: he may fail in the attempt, and ultimately hang himself. Any description of gun-shot wound, provided it be such as to allow of a person surviving a sufficient time, may thus be found on a hanged subject, and yet constitute no proof whatever of homicide. If there are circumstances about the wound or injury which prove that it could not have been self-inflicted, this of course will affect the conclusion; but when such circumstances are not met with, a cautious medical jurist should say, in answer to inquiries respecting the origin of these wounds, that they may have been inflicted either by the individual himself or by *another*. There might be no medical facts which would directly establish either view. Of course if, in any case, the wounds or injuries are of a decidedly mortal nature, and have probably caused death, the presumption of murder amounts almost to positive certainty; for who but a murderer would suspend the dead body of a person so wounded, *immediately* after death? (Ann. d'Hyg. 1835, vol. 2. p. 410.) In one instance of suicidal hanging, there were lacerated wounds upon the head, and a handkerchief was found blocking up the mouth. (Henke's Zeitschrift, 1838, vol. 2. p. 257; 1839, vol. 1. p. 207; also 1840, vol. 1. p. 135; also B. and F. Med. Rev. No. 24. p. 560.)

Was the hanging the result of accident, homicide, or suicide?—Most medical jurists have passed over the subject of *accidental hanging*, probably believing it to be impossible. In the sense commonly implied by the term, it is certainly unusual, but although rare it is a possible occurrence. Dr. Smith mentions a case which occurred some years since, in which a girl of the age of thirteen was hanged by pure accident. She was swinging in a brewhouse, and near the rope used by her for that purpose was another for drawing up slaughtered sheep. In the course of the exercise, her head got through a noose of this second cord, which pulled her out of the swing, and kept her suspended at a considerable height until dead. The following case was communicated to me by one of my pupils. In December 1833, an inquest was held on the body of a boy aged ten years. It appeared in evidence that he had been playing with a child eight years old, who was the only witness of his death. The deceased had been amusing himself in swinging by fastening a piece of plaid-gown to a loop in a cord which was suspended from a beam in the room. In the act of swinging, he raised himself up, and gave himself a turn, when the loop of rope suddenly caught him under the chin, and suspended him until life was entirely extinct. The boy who was in the room with him did not give any alarm for some time, thinking that the deceased was at play. The jury returned a verdict of "accidentally hanged." Another case occurred in London in 1836. A man who was in the habit of exercising himself in gymnasties on the rope, was one morning found dead and suspended in his bed-room. The rope had passed twice round the body and once round the neck, whereby it had caused death, although the legs of the deceased were resting on the floor. There was no doubt that the deceased had been accidentally hanged. These are two among several instances which have come to my knowledge, and it will be seen that the circumstances under which they occurred were sufficiently decisive of the manner in which the hanging took place. Indeed, circumstantial evidence must always suffice for the discrimination of accidental hanging: and we have therefore merely to inquire whether, when an individual is found hanging under circumstances which do not allow of the suspicion of accident, the act has been the result of *suicide* or of *homicide.* A medical witness must remember that this is strictly a question for the jury. It is not for him to say whether a man has hanged himself or been hanged by others, but merely to state, when required, those *medical circumstances* which support or rebut one or the other presumption.

Homicidal hanging.—It has been very truly observed, that of all the forms of committing murder, hanging is one of the most difficult, and it is, therefore, but seldom resorted to. In most cases when an individual has been hanged by others, it has been after death, in order to avert the suspicion of homicide. Hence the discovery of a person hanging, affords *prima facie* evidence of suicide, supposing it to be rendered absolutely certain that death has taken place in this manner. We must, however, admit that an individual may be murdered by hanging, and the appearances about his body will not afford the smallest evidence of the fact. The circumstances which will justify a medical jurist in making this admission are the following. First, when the person hanged is feeble, and the murderer a strong healthy man. In such a case, a child, a youth, a female, or an individual at any period of life, worn out and exhausted by disease or infirmity, may be in this way murdered. Secondly, when the person hanged, although usually strong and vigorous, is at the time in a state of intoxication, stupefied by narcotics, or exhausted by his attempts to defend himself. Thirdly, in all cases murder may be committed by hanging when many are combined against one individual. With these exceptions, then, a practitioner will be correct in deciding in a suspected case, in favour of the presumption of suicide. Unless the person labour under stupefaction, intoxication, or great bodily weakness, we must expect, in homicidal hanging, that there will be evident marks of violence about the body: for there are few who would allow themselves to be murdered without offering resistance,—notwithstanding the assertion of Mahon, that some might submit to this mode of death with philosophical resignation when they saw that resistance was hopeless! The following singular case of attempted murder by hanging is mentioned in Symes's Justiciary Reports, Edinburgh, 1827. A woman, aged sixty-nine, was charged with attempting to hang her husband, who was some years older. It appeared that the prisoner contrived to twist a small rope three times round the neck of her husband, while he was lying asleep. She then tied him up to a beam in the room in such a manner that when the neighbours entered he was found lying at length on the floor, with his head raised about one foot above it. He was quite insensible; his hands were lying powerless by his side, his face was livid, and it was some time before he could be roused. Had he remained three minutes longer in this position, he would have died. According to his statement, he went to bed quite sober, and he was not aware of anything which passed during the attempt to hang him, or afterwards, until he was resuscitated. The prisoner was convicted of the assault without previous malice, she having had no ill-will against her husband, and being at the time intoxicated. It can hardly be considered possible that any man should be so sound asleep as not to be awakened by the attempt thus made to hang him. The probability is, that the prosecutor was, like his wife, intoxicated. A case of alleged murder by hanging, and of considerable difficulty in its medical relations, was tried at the Exeter Summer Assizes, 1851. (*Reg.* v. *Rowe.*) Although the prisoner was acquitted, there were some strong facts leading to the belief that this could not have been an act of suicide.

Some medical jurists have thought that the *mark* left by the cord on the neck would serve as a criterion on which we might depend. Thus it has been said, if the mark be circular, and placed at the lower part of the neck, it is an unequivocal proof of murder. In hanging, the mark of the cord is generally oblique, being higher at the back part of the neck, in consequence of the loop formed by it yielding more in this direction than in front. But it is an error to suppose that this want of obliquity in the impression can afford any evidence in favour of the act having been homicidal. Its form will depend in a great degree upon the fact of the body being supported or not, for it is the weight of the body which causes its obliquity; it will also depend on the manner in which the cord is adjusted. A case of suicidal hanging is related by Orfila, in which the mark of the cord extended horizontally round the neck from behind forwards. (Méd. Lég. tome 2. p. 376.) The slip-knot of the cord was in front of the neck, and it is obvious that when the cord is thus adjusted by a suicide, there will be scarcely any obliquity in the depression produced by it. Equally ill-founded is the assertion, that the existence of *two impressions* on the neck affords positive proof of homicide. One of these impressions may be at the lower part of the neck, and circular; the other, at the upper part, and oblique: it is therefore contended, that the deceased must have been strangled in the first instance, and afterwards hanged. The possibility of a prior attempt being made by a suicide to strangle himself, is not adverted to: "si l'on observe les deux impressions," says Mahon, "l'assassinat est alors parfaitement prouvé." It is fortunate that there are facts on record to oppose to this very decided statement. One of the first cases reported by Esquirol is that of a female lunatic who committed suicide by hanging herself, and on whose neck two distinct impressions were seen — the one circular, the other oblique! These appear to have arisen from the cord having been passed twice round the neck, the body being at the same time partially supported. In some instances, a presumption of homicidal interference may exist if there are two distinct impressions, but it cannot be admitted that they establish the fact of murder.

The injury done to the neck by the cord can rarely afford any clue to the manner in which hanging took place, unless the circumstances under which the body is found favour the presumption of homicide or suicide. Thus the laceration of the muscles and vessels of the neck, the rupture of the trachea and the displacement of the larynx, stretching of the vertebral ligaments, and effusion on the spinal sheath, may be observed in suicidal as in homicidal hanging. The presumption, however, is obviously in favour of the latter when these violent injuries are found to be accompanied by fracture or displacement of the cervical vertebræ, and the body of the deceased is not corpulent, — the ligature by which he is suspended is not of a nature to produce them, and the fall of the body has not been great.

Injury to the cervical vertebræ.—A much disputed question has arisen in medical jurisprudence, whether the cervical vertebræ can become fractured or displaced in *suicidal* hanging. Most medical jurists deny the possibility of this accident occurring,— the displacement or fracture of these vertebræ being rarely observed, even in criminal executions, where the greatest violence has been often used by the executioner. So far as I am aware, there is no case of *suicide* on record in which this injury to the neck existed. The case referred to by Petit, which was left to the decision of Dr. Pfeffer, is unsatisfactory, because the body was not examined; and it is doubtful whether the act was really one of suicide or not. M. Ansiaux, of Liége, in inspecting the body of a woman who had hanged herself, found extravasated blood behind the two first cervical vertebræ, which were more widely separated posteriorly than usual. On removing the vertebræ, the posterior ligament of the spine was found ruptured, and the transverse ligament of the atlas so stretched that the dentiform process of the second vertebra was completely locked against the articular surface. The perpendicular and oblique ligaments were entire. The deceased was a stout, healthy person; when discovered, her body was suspended from a beam at the distance of about a foot and a half from the floor. She had evidently fallen with considerable force. The case of this female will serve to show that severe injury to these deep-seated regions of the neck may be occasionally met with in suicidal hanging. A case somewhat similar to this has been reported by Mr. Campbell de Morgan. (Lancet, August 10, 1844.) A married woman, aged fifty, worn out and exhausted by disease, was found hanging quite lifeless from the rail of a bed, which was not more than five feet eight inches from the ground. The front of her body was turned round towards the bed, the head thrown forcibly backwards,—the knot of the ligature, an old silk handkerchief, being placed in the middle of the under side of the chin. Her heels were about three inches from the ground,—the knees being on a level with the bed-frame, and resting against it. The body was seen by a medical man about an hour after it was cut down. The features were perfectly calm, and there was no trace of congestion about the face: it was pale, and in all respects natural. There was no lividity; the eyes were neither injected nor prominent; the tongue was pale, lying far back in the mouth, and without any mark of indentation. The cord-mark was well defined, of a parchment colour, dry, brown, and hard, without any ecchymosis, but with a thin line of congestion at the upper edge of the groove;—it was very deep at the back of the neck, just over the atlas, probably owing to the head hanging backwards. The mucous membrane of the stomach was pale; the lungs natural: no congestion of the large veins or of the cavities of the heart; the two ventricles contained about an equal quantity of blood. These appearances seem to show that death was not caused either by asphyxia or by cerebral congestion. Neither the trachea nor the great vessels of the neck could have sustained any pressure or constriction. The deep muscles over the second and third cervical vertebræ were ecchymosed; this ecchymosis extended to the sheath of the spinal marrow; and on the left side, and externally to the sheath, there was a large effusion of blood firmly coagulated. There was no displacement of the second or other vertebræ, and the ligaments were sound; but between the third and fourth vertebræ, there was unusual mobility as if they had been stretched. In this case the body was not heavy, and the fall, if any, could have been but trifling. The effusion on the spinal marrow was the cause of death; and its origin was sufficiently explained by the falling back of the head and sudden bending of the cervical vertebræ. Her husband and family were *in an adjoining room, but heard no noise*: it was only by accident that the deceased was discovered.

Circumstantial evidence.—In all doubtful instances, we should not lose sight of moral and circumstantial evidence. We should ascertain whether the individual had been previously disposed to commit suicide or not;—we should observe whether the doors and windows of the apartments are secured on the inside or on the outside;—whether the dress of the deceased is at all torn or discomposed, or his hair dishevelled;—whether the attitude of the body is such as to show interference after death;—whether there are marks of blood about the body, or the ligature;—whether the hands are bloody or present marks of wounding or struggling;—whether the rope or ligature corresponds to the impression seen around the neck;—and lastly, whether the ligature is of sufficient strength to support the weight of the deceased. (Case of *Pinckard*, post, p. 778.) The strongest evidence of homicide is often found in the attitude and the state of the dress of the dead body. It may or may not indicate interference or change after death irreconcilable with the supposition of suicide or accident. On this point the minutest circumstance may become of considerable importance as evidence. When there are indications of violent struggling, the dress may be found disordered, unless it has been smoothed or arranged by the murderer after the death of the deceased (*post*, p. 778). There may of course be no disorder or discomposure of the dress, in the case of a female, when the body is fairly suspended. These points fall, it is true, more within the province of the officers of justice than of a medical practitioner; but the latter is generally the first who is called to see the deceased, and therefore, unless such facts were noticed by him on his visit, they might often remain altogether unknown. The medical opinion, however, must be based only on *medical* facts. Circumstantial evidence has more than once assisted in clearing up a doubtful case. Louis states that on removing the body of a man who was found hanging, the rope was observed to be clotted with blood. This simple circumstance led to further investigation, by which it was discovered that the person had been murdered, and his body afterwards suspended. The presence of marks on the neck indicative of strangulation, such as the cord was not likely to have produced, may lead to a suspicion that the hanging followed death. In April 1829, a boy was found hanging, perfectly dead. On inspecting the body, a round ecchymosed mark, about the size of a dollar, was seen on the fore part of the neck; and near it were several impressions as of fingers in the surrounding skin. There was neither depression nor ecchymosis in the course of the cord. The inspection left no doubt that the deceased had died from asphyxia. It was subsequently discovered that the boy had been first strangled, and afterwards hanged. In another case a man was found hanging in a room. His body was so suspended from a hook, that the trunk was not more than nine inches from the floor; and his legs were stretched out at length. The cord was from two to three feet long, and but loosely passed round the neck.

The furniture of the room was in great disorder, and some marks of dried blood were seen on one part of the floor. The right side of the head and face of the deceased presented several excoriated and ecchymosed marks. There was a circular impression around the neck produced by the cord; but it was entirely free from ecchymosis. On the left side, a little above this impression, there was a strongly ecchymosed mark, which could be traced round to the back of the head. Blood was found extravasated beneath this mark. The lungs presented the characters of asphyxia, but the examiners referred this to strangulation and not to hanging, considering that the body had been suspended after death in order to give the appearance of suicide. Had there been an ecchymosed mark on the neck, which could not have resulted from the suspending cord, the case would have remained, medically speaking, doubtful; because it is well known that the affirmative signs of hanging may be absent, and yet the individual may thus have died. (See the case of *Pinckard*, STRANGULATION, *post*, p. 778.)

The position of the body.— Lastly, it has been contended that the *position* of a body may serve to distinguish suicidal from homicidal hanging. This point was strenuously argued on the investigation which took place relative to the death of the *Prince de Condé* in 1830. According to the opinions of some of the witnesses on that investigation, if the body of a man be found in an inclined posture, or so suspended that his feet are in contact with the floor, the idea of suicide by hanging is at once negatived,—we are rather to suppose that the person must have been otherwise destroyed, and his body afterwards placed in this position by his murderers. Here, then, we are called upon to admit that suicidal hanging is improbable, if not impossible, unless the body of the deceased be found freely and absolutely suspended without any support! This strong opinion, it will be seen, is not borne out by facts. In order that death should take place by hanging, it is not necessary that the body should be freely and perfectly suspended. Cases are of frequent occurrence, where the bodies of hanged persons are found with the feet on the ground, kneeling, sitting, or even in the recumbent posture. These are truly mixed cases of hanging and strangulation. I have the reports of eleven cases of suicidal hanging or strangulation which occurred within a few years. In three the deceased were found nearly recumbent; in four in a kneeling posture,—the body being more or less supported by the legs; and in four, the persons were found sitting. (For many singular cases of this kind with plates, see Annales d'Hyg. 1830, vol. 1. p. 166; 1831, vol. 1. p. 157; 1834, vol. 1. p. 472.) In one instance, the deceased was found on his knees at the foot of the bed, with his cravat round his neck,—the other end being thrown over the bed-rail, and then twisted tightly round his right hand. In another, the deceased, a prisoner, was found dead in the sitting posture. (Ann. d'Hyg. 1831, vol. 1. p. 196.) He was hanging to the iron bar of the window of his prison, which was so low that he was almost in a *sitting posture*. The ligature which he had employed was a cravat, but (what was more remarkable in the case) the *hands of the deceased were found tied* by another handkerchief. The body was warm when discovered. There was not the least doubt of this having been an act of suicide; yet, as the reporter observes, had the body been found in an unfrequented spot, the discovery of the hands *tied*, if not the position, would have led to a strong suspicion of murder. In the opinion of the reporter, the deceased had contrived to tie his hands together by means of his teeth. (Ann. d'Hyg. 1832, vol. 1. p. 419.) Among the cases collected by Esquirol is the following. A patient in La Charité was found one morning hanging by a rope which was attached to the head of his bed. He had fastened this by a loop round his neck, but his body was so retained, that when discovered he was on his knees by the side of his bed. There are one or two similar instances related by the same author. Mr. Webb met with a case in which a man destroyed himself while lying at full length on a bed. His head was in a loop formed by a leathern strap fastened to the bed-post. (Med. Times and Gaz. Aug. 7, 1852, p. 137.) The following case fell within my own knowledge. In 1832, a man was found hanging in his room, with his knees bent forwards, and his feet resting upon the floor. He had evidently been dead for some time, since cadaveric rigidity had already commenced. The manner in which this person had committed suicide was as follows:—He had made a slip-knot with one end of his apron (he was a working mechanic), and having placed his neck in this, he threw the other end of the apron over the top of the door and shutting the door behind him, he had succeeded in wedging it in firmly. At the same moment he had probably raised himself on tip-toe, and then allowed himself to fall; in this position he died. The weight of his body had already sufficed to drag down a part of the apron, for it seemed as if it had been very much stretched. (See also a case by Dr. Albert, Henke's, Zeitschrift, 1843, vol. 2. p. 50.) Casper reports a case in which a man was charged with the murder of his wife because her body was found hanging in almost an erect position. (Ger. Leich. Oeffn., vol. 2. p. 92.) Mr. Rake (a former pupil) has communicated to me the particulars of a well-marked case of suicidal hanging which occurred in August 1852, in which the person was found in almost a sitting posture. A man, æt. 21, hung himself by a silk handkerchief passed through a ring only twenty-six inches from the ground. Mr. Rake saw him in a few minutes after he had been cut down. The body was quite warm. When first seen the man was lying with his feet extended at full length, the handkerchief was drawn tightly round the throat by a slip-knot, and his face was directed towards the ground. Both hands were firmly clenched. There was a well-defined, nearly circular, and much indented mark round the lower part of the neck corresponding to the ligature. The ligature was drawn so tightly at one or two points, as to appear almost buried in the folds of the skin about the neck. There was much ecchymosis at various spots in the back of the neck, and some abrasion of the skin at two or three points. There was swelling with great congestion of the face. There was no escape of blood from the ears.

Mr. Becke, coroner for Northampton, has furnished me with three additional cases, which occurred at the General Asylum for Lunatics in 1852. In the first, the man made a loop of a twisted blanket at a height of less than five feet from the ground, and then kneeling forward, strangled himself, the feet being on the ground and the knees nearly touching it. The fingers were not clenched or contracted, but partially bent. There were no marks of any convulsive struggle except a slight bruise on the wall. In the second case the man hung himself on a beam: the legs touched the ground: the hands were not clenched. In the third the patient had hanged himself by mounting on a shelf in a loft, fastening his neck-handkerchief to a beam, and then swinging himself off. He was found with his right leg suspended in the air, whilst his left leg was supported by the shelf on which he had been standing. His right hand was convulsively clenched, which is said to have been a habit on the part of the deceased: the left hand was open, and the fingers only slightly bent.

Remer found that out of one hundred and one cases of suicidal hanging, in fourteen the body was either standing or *kneeling*, and in one instance it was in a *sitting* posture. Dr. Duchesne has recently published an account of fifty-eight cases in which the suspension of the body was partial,—the feet or trunk being more or less supported. Twenty-six of these cases are new. The reporter comes to the conclusion that *suicide* by hanging is consistent with *any posture* of the body, even when resting upon the two feet. (Ann. d'Hyg, Oct. 1845, vol. 2. pp. 141 and 346.) Further evidence need not be adduced to show how unfounded is that opinion which would attach the idea of homicidal interference to cases in which a body is loosely suspended, or in which the feet are in contact with any support. We ought rather to consider these facts as removing a suspicion of homicide; for there are probably few murderers who would suspend their victims, either living or dead, without taking care that the suspension was complete. Besides, the facts of many of these cases are readily explicable:

—thus, if the ligature be formed of yielding materials, or if it be loosely attached, it will yield to the weight of the body after death, and allow the feet to touch the floor, which they might not have done in the first instance. If there be reason to believe that the body has not altered its position after suspension, we must remember the facility with which insensibility comes on, and the rapidity with which death commonly ensues in this form of asphyxia. (See Med. Gaz. vol. 44. p. 85.)

The limbs secured in suicidal hanging.—One or two points are also worthy of notice in relation to this question. The hands or the legs, but more commonly the former, have been frequently found tied in cases of undoubted suicidal hanging (Ann. d'Hyg. 1832. vol. 1. p. 419); and yet it has been gravely debated, whether it was possible for a person to tie or bind up his hands, and afterwards hang himself! It is unnecessary to examine the ingenious arguments which have been urged against the possibility of an act of this kind being performed; since among many cases that might be quoted, two occurred in 1843, in this metropolis, where the persons died from hanging: the act was suicidal, and the hands were found tied in both instances with a silk handkerchief. A third case occurred at Worcester, in December, 1844, in which the deceased tied his wrists with a silk handkerchief; and secured to this, were two flat irons in order to increase the weight. A remarkable case of suicide in which the hands and ankles were tightly secured has been communicated to the Medical Gazette, by Mr. J. H. Taylor, vol. 45. p. 388; see also cases in Guy's Hospital Reports, Oct. 1851.

STRANGULATION.

CHAPTER 61.

CAUSE OF DEATH—APPEARANCES AFTER DEATH—WAS DEATH CAUSED BY STRANGULATION, OR WAS THE CONSTRICTION APPLIED TO THE NECK AFTER DEATH?—MARKS OF VIOLENCE—ACCIDENTAL, HOMICIDAL, AND SUICIDAL STRANGULATION.

Strangulation. Cause of death.—Hanging and strangulation are usually treated together; and some medical jurists have admitted no distinction in the meaning of these terms. In hanging, the phenomena of asphyxia take place in consequence of the *suspension* of the body, while in strangulation, asphyxia may be induced not only by the *constriction* produced by a ligature round the neck, independently of suspension, but by the simple application of *pressure* through the fingers or otherwise to the trachea. (See a paper by M. Tardieu, Ann. d'Hyg. 1852, vol. 1. p. 107.) It may, indeed, be said, that every individual who is hanged is literally strangled; but hanging is only one form of strangulation, and sufficiently peculiar to claim a separate consideration. We have now, therefore, to direct our attention to the other means which have been employed to obstruct the act of breathing by external pressure on the trachea. These have commonly been arranged and treated under the head of manual strangulation. The *cause* of death is the same in the two cases, namely asphyxia; and the rapidity with which death ensues in strangulation will depend in a great degree on the force employed, and on the completeness with which the respiratory process is obstructed. In strangling, a much greater degree of violence is commonly employed than is necessary to cause asphyxia; and hence, the marks produced on the skin of the neck will be, generally speaking, much more evident than in hanging, where the mere weight of a body is the medium by which the windpipe is compressed.

Appearances after death.—The appearances after death externally and internally are the same in strangulation as in hanging, but the injury done to the parts about the neck is commonly greater in the former case than in the latter. If much force has been used in producing the constriction, the windpipe with the muscles and vessels in the fore part of the neck may be found cut or lacerated, and the cervical vertebræ may be fractured. The face is more commonly livid and swollen, the eyes congested, and the pupils are dilated. The mark of the ligature, if a ligature has been used, is generally circular, and situated at the lower part of the neck. Instances have, however, been related where a circular mark has been observed in hanging; and it is possible that some degree of obliquity may occasionally exist in the course of the depression produced by a ligature in strangulation. A medical jurist ought, therefore, to weigh all the circumstances connected with the position of the body, and the direction of the ligature, before he forms an opinion from the appearances presented by the mark on the neck, whether the person has been hanged or strangled. Much more importance is to be attached to the lividity, ecchymosis, and abrasion of the skin in the course of the ligature, than to the circularity or obliquity of the depression produced by it. In the strangling of a living person by a cord, it is scarcely possible that a murderer can avoid producing on the neck, marks of severe injury; and in the existence of these we have evidence of the violent manner in which death has taken place. On the other hand, a person may be strangled, and yet the ligature, in consequence of its being soft and of a yielding nature, will not cause a perceptible depression or ecchymosis. Such instances must, of course, be rare; because assailants usually produce a much more violent constriction of the neck than is necessary to ensure the death of a person. The general lividity of the body, contraction of the fingers, with clenching of the hands and swelling and protrusion of the tongue, are the same in strangulation as in hanging. Mucous froth may also be occasionally found in both cases. The *internal* appearances are those of asphyxia. The lungs and right cavities of the heart are commonly distended with thick black blood, while the left cavities are empty. The state of the brain and its membranes calls for no particular notice. The blood-vessels are sometimes found distended. In some instances of strangulation it is said that blood has escaped from one or both ears during the act; but this is not a usual appearance. In two well-marked cases, to be related hereafter (p. 778), the constriction was carried to a great degree, but there was no bleeding from the ears. Dr. Geoghegan has informed me that in one case of *suicidal* strangulation which he examined, the constriction had been produced by a ribbon, and the violence applied was sufficient to produce bleeding from one ear. On dissection, this was found to have resulted from a rupture of the membrane of the drum of the ear. There was no froth at the mouth or nostrils, and scarcely any lividity or swelling of the face. It was further observed that the mark on the neck, which was deep, almost disappeared on the removal of the ribbon. Mr. Wilde, of Dublin, met with a case in which rupture of the membrane of the drum of the ear, with effusion of blood, was caused by strangulation. Bleeding from the ears, as a result of rupture of the membrane of the drum, must, however, be regarded as an exceptional appearance. Dr. Chevers does not mention it as having been noticed in any one of the numerous cases which he has collected in his Indian experience, although bleeding from the nostrils has been observed. (Med. Jur. for India, 1856, p. 374.) Without rupture of the membrane of the drum, blood could not issue from the ears, and in order that this membrane should be ruptured, certain conditions not commonly met with may be required. With a probable exception to be hereafter mentioned, I am not aware that there is any well-authenticated instance in which effusion of blood was met with on the brain of a strangled subject. The organs of generation in the male and female may present an appearance of congestion similar to that which is met with in hanging. The appearances commonly presented in strangulation, resemble those described by Mr. Rake, in a case of partial suspension. (See *ante*, p. 766.) In a case which occurred to Dr. Fuller, the body of a woman who had been homicidally strangled presented the following appearances. The skin of the head, face, neck, and chest, was darker than natural, and discoloured underneath, particularly that of the scalp. The brain was suffused by dark blood, the lungs gorged and dark, the bowels of a dusky red colour. The eyes were somewhat protruded and blood-shot, the lips swollen and darker than natural, the tongue slightly protruding between the teeth, and froth issuing from the nostrils. There was a mark of pressure behind the right ear, and other marks on the neck and chest, with discoloration of the muscles. (Chevers's Medical Jurisprudence for India p. 378; see also p. 387.) The state of the hands and feet is not mentioned. Among the occasional appearances of violent strangulation may be mentioned, injury to the windpipe. One case in which the rings of the windpipe were split as a result of pressure was communicated to me by Dr. Inman of Liverpool. Several instances of laceration and rupture of the windpipe are quoted by Dr. Chevers. (Op. cit. pp. 381, 384.) In one instance the ossified thyroid cartilage had been broken and forced inwards, causing suffocation. In *Reg.* v. *O'Brien* (Liverpool Winter Assizes, 1857) a case of alleged murder by strangulation, the cartilage of the windpipe was broken (see *post*, 779). (For an account of the appearances in a strangled body thirty eight days after interment, see Henke, Zeitschrift, 1842, vol. 1. p. 235; vol. 2. p. 310.)

It is always proper in suspected homicidal strangulation to examine the contents of the stomach for narcotic poison.

The medico-legal questions relative to strangulation are of the same nature as those which have been already discussed in treating of hanging. Thus, in examining the body of a person suspected to have been strangled, we may be required to answer the following question :—

Was death caused by strangulation, or *was the constricting force applied to the neck after death?*—The *internal* appearances of the body will yield no evidence whereby this question can be solved; but the *external* appearances are commonly less ambiguous than in a corresponding case of hanging. The ecchymosis about the depression on the neck, when a ligature has been employed, with the accompanying swelling and lividity of the face, are phenomena not likely to be simulated in a dead body by the application of any degree of violence. When the constriction is produced within a few minutes after dissolution, an ecchymosed depression may result; but it is improbable that there should be any lividity or swelling of the countenance. The experiments of Prof. Casper, referred to in the section on hanging (p. 753), bear directly upon the question which we are now discussing. We learn from these experiments, that when the attempt to simulate strangulation in a dead subject is not made until *six hours* at least have elapsed, there is no risk of confounding the mark thus produced with that which is formed when the violence is applied to a living individual. It is probable, that so far as *ecchymosis* is concerned, if the attempt were made after an hour or two hours had elapsed, none would be produced; and with regard to the *non-ecchymosed* mark, it is doubtful whether it could be produced after three or four hours. These periods, it must be remembered, are not settled with positive certainty: the results would probably vary, according to the degree of rapidity with which the body had cooled.

It is difficult to conceive under what circumstances an attempt to simulate strangulation in a recently dead body could be made, unless for the purpose of throwing suspicion upon an innocent person connected with the deceased. When an individual has been murdered, it is not likely that the murderer would attempt to produce the appearances of strangulation on a body after death, under the idea of concealing his crime: for strangulation is in most cases a positive result of homicide, and is rarely seen as an act of suicide. In the absence of ecchymosis from the neck, it will be difficult to form an opinion, unless from circumstantial evidence. It must be remembered, however, that there may not always be an ecchymosed *circle*;—for an individual may be strangled by the application of pressure to the trachea through the medium of the fingers, or of any hard or resisting material. The ecchymosis in such a case will be in detached *spots*. In the absence of all marks of violence round the neck, we should be cautious in giving an opinion which may affect the life of an accused party: for it is not probable that homicidal strangulation could be accomplished without the production of some appearances of violence on the skin over the larynx or trachea. It is doubtful whether strangulation ever takes place without some mark being found on the neck indicative of the means used. The bare possibility of death being caused in this manner, without leaving any appreciable trace of violence, must be admitted: although the admission scarcely applies to those cases which require medico-legal investigation. Suicides and murderers generally employ more violence than is necessary for the purpose of destruction: hence, detection is easy. But if a soft and elastic band were applied to the neck with a regulated force, it is possible that an individual might die strangled, without any external sign being discovered to indicate the manner of his death. Indian surgeons inform us that the Thugs, and other robbers met with in India, are thus accustomed to destroy their victims, with the dexterity of practised murderers. A case involving this question of strangulation, without marks of violence, was tried in France, and from the medical evidence, decided in the affirmative. (Gaz. Méd. 9 Mai 1846, p. 375.) The medical witness should, however, be prepared to consider whether, in the absence of any mark, death might not have proceeded from another cause, and leave it to the authorities of the law to decide from circumstances in favour of, or against, the prisoner. There is, I conceive, nothing to justify a medical witness in stating that death has proceeded from strangulation, if there should be no appearance of lividity, ecchymosis, or other violence about the neck or face of the deceased. Congestion in the organs of generation is an appearance which it would not be safe to take as evidence of death from strangulation. The state of the countenance alone will scarcely warrant the expression of an opinion; for there are many kinds of death in which the features may become livid and distorted from causes totally unconnected with the application of external violence to the throat unless accompanied by other well-marked signs of this mode of death. Let not a witness, then, lend himself as an instrument in the hands of counsel, for the condemnation of a person against whom nothing but a strong suspicion from circumstances may be raised, and where medical evidence is unable to throw any light upon the question of death having resulted from strangulation. (See the trial of *Mrs. Byrne*, for murder, Dublin Commission Court, Aug. 1842.) This trial is full of interest to a medical jurist. Some natural changes in the dead body appear in this case to have been mistaken for marks of strangulation.

Marks of violence.—It is scarcely necessary to state that all marks of violence on the body of a supposed strangled person should be accurately noted, as the questions respecting them are material. The witness will be expected to state whether they were inflicted before or after death: if before, whether they were sufficient to account for death, or whether they were such as to be explicable on the supposition of an accidental, suicidal, or homicidal origin. It should be observed whether there exist any morbid changes, sufficient to account for death, in either of the three great cavities of the body, as this kind of evidence may be essential in the progress of the case.

Was the strangulation the result of accident, suicide, or homicide?—Strangulation, like hanging, is occasionally the result of *accident;* but the occurrence may be looked upon as rare. When the body is not suspended, it is commonly more in the power of an individual to assist himself, and escape from the constriction: hence accidental strangulation is less frequent than accidental hanging. A few instances of accidental strangulation are on record. One is recorded by the late Dr. Gordon Smith. The subject was a boy, who was accustomed to move about with a heavy weight suspended by a string round his neck. One day he was found dead in a chair. The weight appeared to have slipped, and to have drawn the cord tightly round the fore part of his neck. In June 1839, a girl was accidentally strangled in the following manner:—she was employed in carrying fish in a basket at her back, supported by a leathern strap passing round the fore part of her neck, above her shoulders in front. She was found dead, sitting on a stone wall; the basket had slipped off, probably while she was resting, and had thus raised the strap, which had firmly compressed the windpipe. A similar case is recorded by Watson (On Homicide). There will be no difficulty in deciding a question of accidental strangulation from the position of the body and the means of constriction. Should it happen, however, as it is not unlikely, that the body has been removed from the place in which it was first discovered, we can only establish a presumption of accident from the description given by those who discovered it.

When a charge of murder is instituted against a person, an attempt is not unfrequently made by counsel for the defence, to show the probability that the deceased might have fallen while in a state of intoxication, and have become accidentally strangled either by a tight cravat, or by some foreign substance exerting pressure on the trachea. If we admit the possibility of an occurrence of this nature, we must not lose sight of the existence of other more probable modes of death, nor should we allow our judgment to be so swayed as to abandon what is probable for that which is merely possible.

Suicidal strangulation.—This mode of suicide must be regarded as of extremely rare occurrence, and except under particular circumstances, impossible. The possibility of an individual strangling himself was for a long time denied by medical jurists; for it was presumed that when the force was applied by the hand, all power would be lost as soon as the compression of the trachea commenced. This reasoning, which is physiologically correct, is, however, only applicable to those cases in which the windpipe is voluntarily compressed by the fingers. When an individual, determined on suicide, allows the windpipe to be compressed by leaning the whole weight of his body on a ligature passed round his neck and attached to a fixed point, he may perish in this manner almost as readily as if he had hanged himself; for insensibility and death will soon supervene. In the chapter on Hanging, it was stated that suicides were often found with their bodies in close contact with the ground: and cases were referred to in which strangulation was accomplished in the manner above described, while the suicide was in a sitting or kneeling posture. On other occasions, the peculiar disposition or nature of the ligature has enabled a person bent on suicide to strangle himself without much difficulty. An instance is related by Orfila, in which two cravats, that were twisted several times round the neck of the deceased, who was discovered lying on his bed, had effectually served the purpose of self-destruction. (Méd. Lég. vol. 2. p. 389.) Sometimes strangulation has been suicidally effected by a rough cord passed repeatedly round the neck, and tightened by being pulled with each hand. The number of coils would cause some pressure to be exerted even when the grasp was relaxed by death. (See Guy's Hospital Reports, Oct. 1851.) Other cases are related, in which suicides have succeeded in strangling themselves by tightening the ligature with a stick (see case by Mr. Thorp, Guy's Hospital Reports, Oct. 1851); or when the ligature was formed of thick and rough material, by simply tying it in a knot. A young female of Montevrin, in the Canton of Lagny, was found one morning dead in bed, lying on her face, with a woollen garter passed twice round her neck, and secured in front by two simple knots, strongly tied, the one on the other. The body was in an incipient state of putrefaction, but still there was a mark corresponding to the ligature. This was shallow, of a slight greenish colour, especially in front, and presented here and there ecchymosed spots; posteriorly the mark was scarcely visible. The face was livid and swollen: a quantity of sanguineous mucus escaped from the mouth and nostrils. The lips were livid; the tongue protruded, and firmly compressed between the teeth: the body presented, over the trunk and limbs, patches of ecchymosis. On cutting into the mark on the neck, there was no extravasation, neither was there any apparent injury to the deep-seated muscles or adjacent parts; the lungs were gorged with blood, but the other viscera of the body presented no particular appearance. The medical examiners gave it as their opinion that the deceased had died from apoplexy resulting from strangulation. They stated that the head was not examined, and they judged that apoplexy was the cause of death, from the condition of the face. A more important question was, whether the strangulation was suicidal or homicidal. There was some reason to suspect the latter, and indeed a person was pointed out as the probable murderer: but a rigorous medical investigation, relative to the state of the body and clothes, as well as numerous collateral circumstances, satisfactorily established that this was an act of self-destruction. (Ann. d'Hyg. 1829, vol. 2. p. 440. See also a case by Dr. Simeons, Henke, Zeitschrift, 1843, vol. 1. p. 335.)

Sometimes the appearance of the *mark* on the neck will allow us to establish a slight presumption for or against homicide. In homicidal strangulation, from the unnecessary violence used, we may expect to find the skin much ecchymosed, lacerated, or excoriated, and the deep-seated parts, such as the muscles and vessels, as well as the windpipe itself, more or less bruised, lacerated, or extensively injured. Such violence is not commonly to be expected in *suicidal* strangulation.

Supposing the marks of fingers to exist, the presumption is in favour of homicide; as also in all cases where the cause of strangulation is not at once apparent on the discovery of the body. Suicides are not likely to strangle themselves in any other manner than by a ligature applied circularly. If the ligature be still around the neck of the deceased, the position of the knot may throw some light upon the case; if tied in two or three knots at the back of the neck, the presumption is assuredly in favour of homicide. Then, again, the nature of the ligature should be attended to. Suicides generally employ for ligatures those articles which are nearest at hand, — such as cravats, stockings, or garters. Some medical jurists have attempted to limit the varieties of suicidal strangulation; contending that when a subject is found strangled in any other way than in one of those arbitrarily laid down by them as essential to suicide, it is evidence of murder. The fact is, cases as yet are few, and each new instance of suicidal strangulation presents us with something novel in the means of its accomplishment; a sufficient proof, therefore, that we ought to be cautious how we decide these questions by hastily preconceived rules.

The mode in which the notorious criminal, *Greenacre*, attempted to destroy himself by suicidal strangulation, presented some novelty; and certainly it does not fall within the methods which, according to some medical jurists, suicides ought on these occasions to adopt. When, in March 1837, he was confined at a Station-House, he was found by the inspector, who entered the room, lying on the floor, with a handkerchief drawn tightly around his neck by means of a loop, into which he had inserted his foot. When first seen, his face was livid, and he was apparently dead: the handkerchief was cut, and venesection, with other means of resuscitation, were employed with success. The manner in which General Pichegru was found strangled in prison gave rise to a strong suspicion of murder, merely from the singularity of the method adopted. The ligature which he employed was found tightened around his neck by means of a stick, which had been twisted, and then fixed behind one ear. There was no lividity of the face. It was contended that Napoleon had caused the General to be strangled or suffocated, and that the ligature was afterwards applied. The evidence of this having been an act of homicide is very weak; and so far as the medical circumstances extend, there is no reason to doubt that it was an act of suicide. The only obstacle to the admission of this, in the opinion of some jurists, was the employment of a stick for the purpose of tightening the ligature: but there are at least two similar cases on record, in which a suspicion of murder could not be entertained: one of these is referred to by Metzger (Op. cit. p. 309), and another is recorded in Guy's Hospital Reports for October, 1851. There may be disease, such as paralysis, or deformity in one or both of the arms, which may render it impossible for an individual to tie a ligature around his own neck. The only caution here to be guarded against is that we do not push this doctrine too far. When there is a fixed resolution, many apparent impossibilities may be overcome by a person bent on suicide. The following case is, in this respect, instructive. A middle-aged woman was brought into the Hôtel-Dieu, March 1833, labouring under such a degree of mental excitement as almost to amount to insanity. Soon after her admission she destroyed herself by strangulation. The nurse, in going round the ward, saw her lying at the side of the bed with her head hanging out. Upon examination, it was found that she was quite dead, and that there was a silk handkerchief around her neck. The handkerchief had been carried twice round the neck, and then tied in front. The eyes and eyelids were strongly reddened and swollen. The mark of the ligature around the neck was deep, ecchymosed, and partially excoriated: the brain, though a little vascular, was healthy. The other viscera presented no appearance calling for notice. (Ann. d'Hyg. 1833, vol. 2. p. 153.) It is worthy of remark, that in this instance, in which there could be no doubt of suicidal strangulation, the deceased had lost *four fingers of her right hand*, so that this member had been from an early period, of but little service to her; nevertheless she contrived to tie the cravat round her neck with great firmness and dexterity. It is easy to conceive that had her body been found in a suspicious locality, a plausible opinion of homicidal strangulation might have been formed from the maimed condition of the hand. This case, then, will serve to convey a proper caution in drawing inferences as to what persons labouring under any corporeal infirmity are capable of doing, when they make attempts on their own lives.

Although the cases just related show that suicidal strangulation may be effected under singular circumstances, yet in a case of murder by strangulation, it would not be easy to simulate suicide: it would at any rate require great skill and premeditated contrivance on the part of a murderer, so to dispose the body of his victim, or to place it in such a relation to surrounding objects, as to render a suspicion of suicide probable. Thus, if the ligatures should be found loose or detached,— if the ecchymosis or depression should not accurately correspond to the points of greatest pressure,—if, moreover, the means of compression were not evident when the body was first discovered and before it had been removed from its situation, there would be fair grounds for presuming that the act was homicidal. In cases in which strangulation has resulted from a compression of the windpipe by the fingers, and where there are fixed ecchymosed marks indicative of direct manual violence, we have the strongest presumptive evidence of murder; for neither accident nor suicide could be urged as affording a satisfactory explanation of their presence.

Homicidal strangulation.— Strangulation occasionally comes before our Courts of law as a question of murder: and when a party has been tried upon a charge of this kind, the circumstances have been commonly so clear, as to have rendered the duty of a medical witness one of a simple nature. Difficulties, however, occasionally arise, as may be seen by reference to the cases of the *Queen* v. *Taylor* (York Lent Assizes, 1842), and the *Queen* v. *Greek* (Salisbury Lent Assizes, 1843). See also the important case of the *Queen* v. *Reynolds* (Central Criminal Court, Dec. 1842). Here it was left uncertain by the medical evidence, whether death was due to strangulation, or malicious exposure to cold; and as the indictment only charged the former act, the prisoners were acquitted! See likewise the case of *Queen* v. *Fowles* (Stafford Lent Assizes, 1841). For a full report of a case in which the question was, whether the deceased had committed suicide by hanging, or had been strangled by her husband, I must refer the reader to Cormack's Journal for 1844, p. 344. The prisoner was acquitted on a verdict of "Not proven;" but there could be no doubt of his guilt. A case of alleged murder by strangulation (*Commonwealth* v. *Flanagan*), will be found reported in the American Jour. of Med. Sciences, Oct. 1845, p. 389. See also the case of *Reg.* v. *Drory*, Guy's Hosp. Reports, Oct. 1851.

Within a recent period several important cases of murder by strangulation have been brought to trial in this country. In two of these, I was required to investigate the circumstances, and give evidence respecting the mode in which death took place, and the medical reasons which led to the inference that the deceased persons could not have died by their own hands. For a full report of one of these cases (*Reg.* v. *Drory*, Essex Lent Assizes, 1851), I must refer the reader to the Guy's Hosp. Rep. Oct. 1851. The deceased, a female, was found lying upon her face strangled, with a rope coiled three times round her neck, the two inner coils being tight and the outer coil loose, the end of the cord being placed loosely near the left hand of the deceased, which was raised towards it. The length of the free portion of cord was not sufficient to allow of the deceased grasping it and tightening it to such a degree as to produce the great amount of violence found on the neck. This, with other facts, tended to prove that the act must have been one of murder. In another case (*Reg.* v. *Pinckard*, Northampton Lent Assizes, 1852), it was proved that deceased was found sitting in a corner of her room, with a narrow tape round her neck, hung loosely and singly over a small brass hook about three feet above her head. Her clothes were placed smoothly under her, and her hands stretched out by her side. There was a severe bruise over the right eye, and there were marks of blood on the tape, as well as on the floor and wall of the room at a distance from the body. There was a stain of blood on the knot of the tape where it passed over the hook; and there was no blood on the hands of the deceased. The windpipe for about an inch and a half was lacerated longitudinally in its rings, and there was a deep mark round the neck in the course of the doubled tape, as if from great pressure applied by some person, or from the weight of the suspended body. The latter hypothesis was untenable. The body of the deceased did not weigh probably less than 120 pounds, while the tape found round her neck broke with a weight of 49 pounds: hence the deceased could not have been suspended by it. This fact, with the smooth arrangement of the clothes, the severe marks of violence on the body (inexplicable on the hypothesis of suicide), and the marks of blood and struggling in the room, proved that there had been homicidal interference; and the crime was brought home to the prisoner by a series of moral and circumstantial proofs. Both of these criminals confessed their crimes before execution. [The reader will find other reports of cases of alleged death from homicidal strangulation in the Med. Gaz. vol. 41. p. 295; and vol. 44. p. 1084.]

In directing attention to circumstantial evidence, it was suggested that the dress of the deceased might be torn or discomposed, a fact indicative of a struggle, and, *cæteris paribus*, incompatible with suicide; but it is proper to remark that evidence of murder, as in *Pinckard's* case, may be obtained, by finding a smooth and undisturbed state of the dress, as well as attitude of the body. In fact, whosoever attempts to imitate suicide under such a form of murder, must, when the facts are properly investigated, inevitably fail in his object. The assassin either does too little, or he does too much. The woman who committed the murder in *Pinckard's* case, had been a nurse in an Infirmary, and accustomed to lay out dead bodies. After the murder, she appears to have carried out unthinkingly her professional experience, by smoothing the clothes under the body, placing the legs at full length, the arms out straight by the side, and the hands open and laid out! Such a condition of the body was quite inexplicable on the supposition of suicide, considering the amount of violence which must have attended the strangulation. In the case of *Drory*, the criminal had attempted to make the death appear like an act of suicide by placing the lower end of the rope near the hand of the deceased: but he selected the *left* hand when the deceased was right-handed, and he did not leave enough rope free from the neck for either hand to grasp in order to produce the violent constriction observed!

It is proper to notice, in this place, the frequent occurrence within the last few years of what are called "*Garotte robberies.*" The system of murder pursued by the Thugs in India, appears to have been imported into England, and many lives have been destroyed in the manufacturing districts and in large towns by the employment of strangulation as a means of robbery. In spite of some convictions, the greater number of criminals have hitherto escaped the penalties of the law. The attack is made during darkness: the person is seized by the windpipe from behind, or a bandage is thrown around his neck, and this is suddenly tightened while accomplices are engaged in perpetrating robbery. The person assaulted, if he should recover, is seldom able to identify an assailant,—he is rendered immediately senseless and powerless: he can give no alarm, and he can offer no resistance. Recovery or death in such cases depends on the lapse of a few seconds more or less, during which the constriction of the neck is continued, — on the degree of constriction, and on the age, sex, and strength of constitution of the person assaulted. There appears to be no law which is sufficient to meet this crime with appropriate severity. The 1 Vict. c. 85, s. iii. makes it felony to attempt to strangle with intent to commit *murder*, and the 14 and 15 Vict. c. 19, makes no provision for the crime. The intent in these cases is to commit robbery, and not murder: this is an accidental result, for which the assailants, if detected, can be punished. But it is desirable to put an end if possible to a means of perpetrating robbery which places a man in the greatest jeopardy of his life, which deprives him of all power of resistance or of giving alarm, and such attempts should be treated as something more than assaults. The use of stupefying drugs to commit felonies is severely punished by the 14 and 15 Vict. 19, and the same punishment should be assigned to those who resort to partial strangulation for a similar purpose.

Marks of violence.—It may be inquired whether *marks* of violence on the body or blood-stains on the clothes or furniture, do not afford strong evidence of *homicidal* strangulation. The answer is—if the marks of violence be such that they could not possibly have arisen from any accident before death, or that they could not possibly have been self-inflicted, they afford the strongest evidence of murder. But the cases wherein so positive an answer can be returned are exceptions to the rule. It is not always in our power to distinguish *accidental* or *self-inflicted*, from homicidal violence; and we are always bound to look to the possibility of accident, or of previous attempts at suicide, being the source of those personal injuries which may be apparent on a strangled subject.

In the following case, communicated to me by Dr. Campbell of Lisburn, the marks of injury to the neck clearly established homicidal strangulation. The dead body of an old man, aged 70 years, was found lying in a potato-field adjoining his house, on the 10th of October, 1842. His family consisted of a son, the son's wife, and a male servant, brother to the son's wife. The deceased had gone to gather potatoes for the servant who was digging. On its being known to their neighbours that the body had been found in the field, suspicions were excited that his death had resulted from violence. An inspection of the body was ordered. The depending parts were livid, owing to their position. On opening the skull, a large quantity of dark fluid blood escaped: the membranes of the brain were greatly injected, the sinuses gorged with blood, and the brain itself was highly congested. Several clots of blood were observed in the lateral ventricles and some over the surface of the brain. In the chest the lungs were filled with dark fluid blood, the air-cells were ruptured, and there was considerable emphysema. The right side of the heart was greatly distended with dark blood; there was nothing remarkable in the abdominal viscera, but the lining membrane of the stomach was congested. The stomach was about half filled with potatoes. On the neck, over the left wing of the thyroid cartilage, there was a slight mark of a crescentic form, with a corresponding though slighter mark on the opposite side; and on removing the skin over these marks a considerable amount of coagulated blood was seen immediately beneath, and in the substance of the muscles. On removing this, the left wing of the cartilage, which was ossified, was found much depressed, and traversed by a fracture nearly an inch in length. From the general appearances presented by the body, together with the injury to the thyroid cartilage, an opinion was given that death had arisen from manual strangulation,—and from the particular form of the external marks over the neck,—*by a left-hand.* Several witnesses were examined, who proved that the deceased and the servant were on bad terms, the deceased having threatened to dismiss the servant, and that before they had gone to dig the potatoes, the servant said he would be revenged of his master. The servant was committed for trial at the ensuing assizes. One of the magistrates present desired that the prisoner might be requested to throw a stone, in order to ascertain if he was left-handed, which he did with the *left-hand.* At the trial, the sister of the prisoner swore that she saw her brother strangling the old man; and several witnesses proved that he had maltreated the deceased on many previous occasions. The counsel for the defence advocated the prisoner's case so well, and proved the sister to be of so bad a character, that the jury, having some doubt as to her veracity, acquitted him. Dr. Campbell forwarded to me the ossified larynx, which was fractured, as described in the report of the case. For the account of a case by Dr. Keiller, in which fracture of the larynx was properly regarded as a strong fact in favour of homicidal strangulation, see Ed. Med. Journal, Dec. 1855, p. 527.

There may be *several marks* on the neck; but then the person may have tried to strangle himself more than once. The throat may be cut,—there may be a deep-seated stab or gun-shot wound, involving some of the important organs of the body, or poison may be found in the stomach;—but in a purely medical point of view, how are we to know that the deceased did not actually inflict the wounds upon himself or take the poison before making the attempt? In the chapters on Drowning and Hanging, we have seen what suicides can do, when they are desperately bent on destroying themselves. These injuries often create serious difficulties to a medical jurist, which it requires the greatest caution and prudence on his part to meet and explain. The prejudice of the public mind is such, that the discovery of a strangled person, with marks of personal injury or of poisoning in his stomach, would, in most cases, lead to a declaration of murder, unless the facts rendered it clearly impossible that any attempt could have been made on his life. It is against this prejudice that a medical witness must strenuously guard himself:—he may be abused for not joining in the outcry of the vulgar; but the best recompense for this abuse will be the conviction that he is interposing the shield of science to protect a possibly innocent fellow-creature from the senseless denunciations of ignorance.

It cannot be disputed that in contested questions of suicidal or homicidal strangulation, rare as they are, we must be often greatly indebted to evidence founded on circumstances, as well as to moral presumptions. How far a medical jurist may be allowed to make use of these in the formation of an opinion, it will be for the Court to determine. Generally speaking, his duty is rigorously confined to the furnishing of medical evidence from medical data alone: but instances present themselves in which this rule must be departed from, or the course of justice will be impeded. Besides, there are numerous circumstances of a collateral nature which may materially modify a medical opinion. Thus, the sight of a ligature, the state of the dress, and the attitude of the deceased when discovered, although not strictly medical circumstances, bear directly upon them; and that evidence ought not to be objected to which is partly founded upon facts of this nature. It must occur to all, that without circumstantial evidence, the best medical opinion in these cases will often amount to nothing. It may be, for example, no more than this: the case is either one of homicide or suicide: and why is such an indefinite answer to be returned? Because, in the abstract view of strangulation, it is not easy to determine whether a ligature was *suicidally* applied round the neck or not. The appearances may be in many cases the same: and where they are different, this difference may be due to accident so that it is a mistake to suppose that we must look to medical circumstances *alone* for clearing up this intricate question. On some occasions the theory of homicide or suicide will equally suit the facts. The cases of *Dr. Franck* and his son, which occurred at Brighton in November 1855, were of this ambiguous character. Whether the son strangled himself, or was strangled by his father were questions which could not be satisfactorily solved by medical, moral, or circumstantial evidence. Unfortunately the bodies did not undergo a proper medico-legal inspection.

There is, perhaps, one instance which may justify a presumption of homicide. A man, in strangling himself, is not likely to vary the means: it is commonly due to a sudden impulse, if we may judge from the moral proofs afforded in the instances on record. The article which is nearest to the suicide is seized, and made the instrument of destruction. It has already been stated as doubtful whether a person could strangle himself by the mere application of the fingers to the trachea: the discovery of such *marks only* as would indicate this kind of strangulation, therefore, renders suicide in the highest degree improbable. But these marks may be sometimes ascribed to the deceased having fallen with his hand possibly applied to his neck, and the inference will be drawn that they have accidentally resulted from the pressure of his own fingers. This is an improbable mode of accounting for the production of ecchymosis or excoriation of the skin. If, besides these marks of fingers, we find a circular mark, with a ligature still around the neck, the presumption of murder becomes, indeed, strong. It may be said, that a person might at first try to strangle himself with his fingers, and, not succeeding, might afterwards employ a cord. But the degree to which the coincidental impressions exist will assuredly in general remove this objection. A murder was committed some years since in this country in the manner here stated. A gentleman of fortune was found strangled on board of a ship in the port of Bristol. Besides the mark of a rope drawn tightly round the neck, there were distinct impressions of nails and fingers in front of the throat. An investigation took place, and the result proved, as, indeed, this state of the neck rendered it almost certain, that the deceased had been murdered. It was afterwards confessed by one of the murderers, that they had first strangled him with their hands, and then drew the rope about his neck, to ensure the certainty of his death.

SUFFOCATION.

CHAPTER 62.

SUFFOCATION FROM MECHANICAL CAUSES — VARIOUS FORMS OF — CAUSE OF DEATH — APPEARANCES AFTER DEATH—EVIDENCE OF DEATH BY SUFFOCATION — ACCIDENTAL. SUICIDAL, AND HOMICIDAL SUFFOCATION—MEDICAL AND PHYSICAL EVIDENCE OF THE CAUSE OF DEATH—SMOTHERING.

Suffocation from mechanical causes. — By suffocation we are to understand that condition in which the air is prevented from penetrating into the lungs, not by constriction of the windpipe, but by some mechanical cause operating on the mouth externally, or on the throat and larynx internally. In this sense, it will be perceived that drowning is nothing more than death by suffocation.

There are many varieties of death by suffocation, all of which are of great medico-legal interest. 1. The continued pressure of the hand over the mouth and nostrils, or the placing of a plaster or cloth over these parts, combined with pressure on the thorax : this was formerly not an unfrequent form of homicidal suffocation. 2. Smothering, or the covering of the head and face with articles of clothing, &c., which effectually prevent respiration. 3. The accidental or forcible introduction of foreign bodies into the mouth and throat. 4. The plunging of the face into mud, snow, dust, feathers, or similar substances. In all of these cases death takes place from asphyxia, and with great rapidity if the chest sustains at the same time any degree of forcible compression. 5. Swelling or spasm of the glottis produced by the contact of corrosive substances. A case was referred to me in July 1848, in which death was probably thus caused by the application of a strong solution of pernitrate of mercury to an ulcer in the throat.

Suffocation may also arise from morbid causes : such as a diseased state of the parts about the throat, a morbid enlargement of the thymus or other glands, the sudden bursting of a tonsillary abscess, or the effusion of lymph, blood, or pus into the windpipe, or about the rima glottidis. Any of these causes may suddenly arrest the respiratory function ; a fact which can only be determined by a proper examination of the body. Among many cases of death from suffocation produced by mechanical causes which have been reported, the following are deserving of notice. 1. A boy died in half an hour under alarming symptoms somewhat resembling those of poisoning, and it appeared that a simple medicinal powder had been given to him about five minutes before the attack! On inspection Dr. Geoghegan found the lower part of the windpipe blocked up with cheesy scrofulous matter:—it was evident that the child had died from asphyxia as a result of disease, and not from the medicine. 2. The following case was communicated by Mr. Edwardes to the Medico-Chirurgical Society. A child of eight years of age, while at play, was suddenly seized with symptoms as of a fit. He was quickly carried home; became violently convulsed; although retaining consciousness and the power of utterance, the countenance became extremely anxious, and he uttered the expression that he should die. In the hurry of the moment there was no opportunity of getting any distinct knowledge of the previous history, beyond the surmise that the boy had swallowed something. The trachea was immediately opened: a little air issued from the opening; artificial respiration was attempted, but without effect, as the child gave but two gasps after the operation, and died. An inspection revealed the presence of a foreign body in the upper part of the air passages. The substance was whitish, and covered with mucus. On examination it was evident that the body was a bronchial gland. Upon slitting open the windpipe, the spot whence the gland had issued was soon observed. 3. A man, aged 31, was put to bed drunk, having previously vomited; and shortly afterwards he was found dead. On inspection Dr. Jackson, of Leith, discovered the usual appearances of asphyxia, *i. e.* congestion of the lungs and of the right cavities of the heart. He was thus led to examine the air-passages carefully, and he found, lying over the upper opening of the windpipe (rima glottidis), a thin and transparent piece of *potato skin*, so closely applied to the fissure as to prevent respiration. The man had died suffocated from this mechanical cause. He had had potatoes for dinner the day before; the piece of skin had probably been thrown up at the time of vomiting, and had been drawn back by inspiration into the singular position in which it was found. Owing to intoxication, the deceased was probably unable to cough it up. I agree with Dr. Jackson in thinking that this case conveys a caution in making inspections. In England, the verdict would most probably have been, "Died by the visitation of God," without an examination of the body! The result clearly shows that in every case of sudden death there should be a strict investigation. (Ed. Med. and Surg. Journ. April 1844, p. 390.) Mr. Nason communicated to me a case (Sept. 1860), in which a child, seventeen months old, died suddenly during a violent fit of coughing. On a minute inspection to determine the cause of death, a full-grown pea was found firmly fixed in the larynx, between the cricoid and thyroid cartilages, blocking up the air-passages. It was probable that it had been in the air-tubes some time, as there was muco-purulent matter effused, and under a sudden fit of coughing, it had been thrown into the position in which it was found, thereby causing death by suffocation. Dr. Richardson met with a case of death from suffocation, caused by the vomiting of the contents of a full stomach; a portion of the food having blocked up the throat. A case similar in its details occurred to Mr. Matthews. (Lancet, Aug. 31, 1850, p. 262.) Children are often suffocated from small portions of food penetrating into the air-passages; and unless an inspection of these parts is made, death may be easily referred to some natural cause. (See case by Mr. Synnot, Med. Gaz. vol. 40. p. 994; also Lancet, May 16, 1846, p. 561.) In some instances, a retraction of the base of the tongue may lead to the suffocation of a new-born child. (Seller's Journal, March 1854, p. 278.) Accidental suffocation from the impaction of large masses of food is by no means uncommon. If the glottis (the opening of the windpipe) be completely closed by food, death may take place suddenly. It does not follow, however, that a person so situated is incapable of making some exertion, or of locomotion. Dr. Mackenzie relates a case in which a man was suddenly choked by swallowing a large piece of meat. He immediately walked across the street to a chemist's shop, and soon after entering it, he fell down in a state of asphyxia. After death, the throat was found to be filled with a piece of beef, which rested on the glottis, and had pressed the epiglottis forward. Part of the mass had entered the windpipe through the rima glottidis. It is probable that in this and similar cases the foreign body does not so completely close the aperture as to prevent some degree of respiration, but the blood being imperfectly aerated, asphyxia is speedily induced. (Ed. Month. Jour. July 1851, p. 68.) In a case which occurred in April 1858, a youth, æt. 17, lost his life, owing to an oyster becoming impacted in the air-passages during the act of swallowing.

A person has been wrongly charged with causing the death of another, when the cause was really owing to the impaction of food in the larynx. A remarkable instance of this kind occurred at Hillingdon: it is reported in the Lancet for March 9, 1850, p. 313. Deceased had had a quarrel with the accused, who was his son-in-law, and they were seen to fall to the ground together, while struggling and fighting. They were separated. About two hours afterwards, the deceased, who appeared quite well, was observed to rise from the dinner-table and leave the room. He was found leaning against the cottage, as if in a falling position, and he expired in two or three minutes! The party with whom deceased had been fighting was charged with manslaughter before a magistrate. At the inquest, the medical witness stated that he found the organs of the body, excepting the brain, in a very healthy state. The brain was excessively congested, and he attributed death to apoplexy. Mr. Wakley desired the witness to examine the mouth and throat (which he had omitted to do at the inspection), as from the suddenness of death after eating, he (the coroner) thought the man might have been choked. This opinion turned out to be correct. A large piece of meat was found wedged in the opening of the throat. This had caused death by suffocation. It had not completely closed the air-passages in the first instance: hence the man was able to move from the dinner-table. The person accused of manslaughter was discharged. A medical jurist, however, must not lose sight of the fact that a foreign substance may be *homicidally* impacted in the larynx; and, except by a careful examination, death may be wrongly assigned to accident. A case reported by Dr. Littlejohn is in this respect instructive. In examining the body of a woman who it was stated had died suddenly, he found a quart-bottle cork inserted tightly into the upper part of the larynx. The sealed end was uppermost, and was roughened by the passage of the screw. Fractures of the ribs were found, and it was quite clear that deceased had not died a natural death. It was suggested that the deceased, while extracting the cork from the bottle with her teeth, might by the sudden impetus of the contained fluids have drawn it into the position in which it was found. But this theory was negatived by the sealed end of the cork being uppermost, as well as by the structure of the parts. The medical opinion was, that the cork must have been forcibly placed there by another person, while the woman was in a helpless state of intoxication. There could be no doubt that this was a deliberate act of murder. Five persons were present with the deceased at the time of her death, but it was impossible to fix with certainty upon the individual who had committed this act, and the man on whom the strongest suspicion fell was acquitted on a verdict of "Not proven." (Ed. Med. Jour. Dec. 1855, p. 511; and for a report of the trial,—the same journal, p. 540.)

Cause of death.—It has been already stated that death takes place by apnœa or asphyxia; and this occurs with a rapidity proportioned to the degree of impediment existing to the passage of the air. There does not seem to be any reason to attribute death to apoplexy. The congestion of the cerebral vessels may be regarded as a consequence of the disturbance of the functions of the lungs. If the veins of the neck were opened so as to prevent an accumulation of blood in the cerebral vessels, it is pretty certain that the prevention of respiration would destroy life under the same circumstances and within the same period of time. Therefore we may regard death from suffocation as resulting from pure asphyxia.

Appearances in the body.—There are rarely any considerable marks of violence externally. When the body has become perfeetly cold, there may be patches of lividity diffused over the skin; but these are not always present. The lips are livid, but the skin of the face is often pale. There is a mucous froth about the lips and mouth. The mouth, throat, and parts about the windpipe should be examined for foreign substances. Internally the lungs and right cavities of the heart may be found distended with blood. The state of the heart and lungs may vary, as in other forms of asphyxia (*ante*, p. 723). The abdominal viscera have been observed to present patches of lividity. Casper has found the kidneys more strongly congested with blood than the liver, spleen, and other organs. (Ger. Leich-Oeffn. 1853, 1. s. 78.) The vessels of the brain are sometimes congested; but at other times they do not appear to be more than ordinarily full. Their condition may be affected by the slowness or rapidity with which death takes place. All other appearances are of an accidental nature, and are not at all connected with death by suffocation. (See cases by Casper, Med. Gaz. vol. 44. p. 1084; also a series of papers by Dr. B. W. Richardson, Med. Gaz. vol. 47. p. 359, *et seq.*)

In a case of alleged murder by suffocation respecting which I was consulted in December 1857, the following appearances were met with. The body was lying on a bed: the right leg was drawn up towards the body, the right arm was bent with the hand directed towards the face. The left hand was lying upon the chest. The lips were livid, the tongue protruded and swollen, and there was a bloody fluid issuing from the nostrils. There was no mark of constriction on the neck—the eyes were half open: the body was rigid and still warm. The face and neck were much swollen, and the skin of these parts as well as of the chest, abdomen, arms and legs was covered with black patches. The brain was gorged with venous blood. The heart was soft and flaccid, and its cavities were empty. The mucous membrane as well as the tissues of the air-passages were much congested with dark liquid blood. The blood was everywhere liquid. The stomach contained a small quantity of dark liquid. and the greater end was reddened. The spleen was congested with dark liquid blood. The emptiness of the cavities of the heart was at first considered to be inconsistent with death from asphyxia; but this condition of the heart is occasionally met with (p. 723) It may be stated that in this case the deceased, a female, was greatly exhausted by sickness and diarrhœa. On the second day of her illness she was found dead in the state described, and her husband was charged with having suffocated her.

Evidence of death from suffocation.— In medical jurisprudence, there is not, perhaps, an instance in which we have fewer medical data upon which to base an opinion, than in a case of alleged death from suffocation. The inspection of the body of a person suffocated, presents so little that is peculiar, that a medical man, unless his suspicions were roused by circumstantial evidence, or by the discovery of foreign substances in the air-passages, would probably pass it over as a case of death without any assignable cause; in other words, from *natural* causes. In examining the body of the woman *Campbell*, who was murdered by *Burke*, in Edinburgh, Dr. Christison was unable to come to a conclusion respecting the cause of death until some light had been thrown on the case by collateral evidence. On this occasion a violent death was suspected, because there were marks of violence externally, and the face of the deceased exhibited the characters of strangulation; but these conditions are by no means essential to death from suffocation, and when they exist, they can only be regarded as purely accidental accompaniments. Appearances similar to those found in the bodies of suffocated persons are frequently met with in inspections when death has taken place as a consequence of disease or accident. They can, therefore, furnish no positive evidence of the kind of death; they do not even permit us to establish a presumption on the subject, until, by a careful examination of the body, we have ascertained that there is no other cause of death depending on organic disease or on violence. Medical evidence may, however, be serviceable in some instances. Thus, let the general evidence establish that a deceased person has probably been suffocated,—the witness may have it in his power to state that the appearances in the body are not opposed to the supposition of this kind of death; that the body is in all respects healthy and sound: and that the death was probably sudden, as where, for instance, undigested food is discovered in the stomach. In all cases of this description, we must bear in mind that our opinion relative to the supposed cause of death is to be formed from the *medical* circumstances only, and from what we have ourselves seen, unless it be otherwise ordered by the Court. From this want of clear evidence, great difference of opinion on the cause of death frequently exists among medical witnesses. In *Reg.* v. *Heywood* (Liverpool Summer Ass. 1839), some of the witnesses referred death to suffocation, others to apoplexy. (Lancet, Sept. 14, 1839, p. 896.)

Accidental, suicidal, and homicidal suffocation.—Accidental suffocation is by no means uncommon; and there are several varieties of accident under which a person may die suffocated. 1. Diseases about the tongue, larynx, or throat, may have advanced to such an extent as effectually to impede respiration. 2. The deceased may have fallen, and the mouth become covered with dust or other substances; and if the person be helpless, as in the case of an infant or an aged person, or of one who is intoxicated, death may thus easily take place. A child was found dead in a room, with its face in the ashes under a grate. It had fallen during the absence of the mother; and from its helpless condition, had speedily become suffocated. Some of the ashes were found in the windpipe. (Med. Gaz. vol. 17. p. 642.) For a case in which suffocation was caused by a pea, see the same journal, vol. 29. p. 146. In trials for murder or manslaughter, a medical opinion respecting the possibility of the accidental suffocation of a drunken person, under similar circumstances, is very often required. These subjects, it must be remembered, are generally to be considered as helpless as children:—if they fall in a position so that the mouth is covered, it is possible that they may have been so intoxicated as not to be able to escape. 3. A portion of food may have remained fixed in the larynx or throat. Children are often accidentally suffocated by drinking boiling water from a tea-kettle. The parts about the larynx then become swollen from the action of the hot water, and respiration is arrested. 4. Accidental suffocation is not uncommon among infants, when they sleep with adult persons. A child may be in this way speedily destroyed. Even the close wrapping of a child's head in a shawl to protect it from cold may effectually kill it, without any convulsive struggles to indicate the danger to which it is exposed (*post*, p. 795). Convulsions by no means necessarily attend on death from suffocation.

A few years since a coroner's inquest was held on the body of a child, found dead in bed; and I assisted a friend in the inspection after death. It was lying in a composed attitude on the bed, with the face nearly covered. There were faint traces of cadaveric lividity about the neck and back; but the body did not present the least mark of violence. The face was pale, but the lips were livid. On examining the chest, the great vessels connected with the heart and lungs were found congested with blood. The vessels of the brain were empty. There were no morbid appearances whatever in any of the other organs. The account given by the girl who attended the child was, that she had laid it to sleep about nine o'clock in the morning, covering over the greater part of its face. She remained in the room; but in the course of an hour, not hearing the child breathe, she looked, and found it dead. The only opinion which we were asked to give was,—whether, from the circumstances, suffocation was probable? We answered in the affirmative; and a verdict of accidental death was returned. This case shows the ease with which an infant may be destroyed, even when its respiration is only partially impeded. The weight of the clothes may have combined to cause death by preventing the free expansion of the chest.

Those instances of accidental suffocation which depend on disease or on the impaction of food, are easily known by an examination of the body:—generally speaking, they present no difficulty. (See cases, *ante*, p. 786; also Med. Gaz. vol. 42. p. 970; also Lancet, Sept. 2, 1848, p. 259.) But in other instances, *e.g.* when a child or a drunken person is presumed to have been suffocated owing to the position in which he has fallen, evidence as to the position of the body, or even the actual sight of the body, is necessary before forming an opinion. The following questions may here arise:—Was the position such as to be explicable on the supposition of accident? Was it not such a position as might have been given to it by a murderer? Could not the deceased have had strength or presence of mind to escape? Could he have been actually suffocated in the position in which his body was discovered? A little reflection upon the circumstances,—for here something more than *medical* circumstances will be required,—may enable us to give satisfactory answers to these questions.

A remarkable case of accidental suffocation was communicated to me by a former pupil, Mr. Rake. A groom was found dead, with his head downward, in the iron rack used for feeding horses with hay. His legs projected from the hole in the floor above. The space was so narrow that there had been no room to turn, and there was no fulcrum by which the deceased, who had thus fallen head downwards into the hole, could again raise himself. There was no doubt that, in reaching into the hole, the deceased had accidentally fallen head foremost into the rack in the midst of the hay, and he had died in this position, without the power to raise an alarm or to make any successful effort for his extrication. It is possible that homicide might be committed in this manner; but there was no reason to suspect it in this instance.

Suicidal suffocation.—As an act of *suicide*, suffocation is extremely rare. It would require a peculiar adaptation of means, and considerable resolution, in order that a person should thus destroy himself. The following case occurred in France some years since. A woman locked herself in her room with her young child:—she placed herself under the bed-clothes, and desired the child to pile the several articles of furniture in the room upon her. When the apartment was entered some hours afterwards, the woman was found dead. She had evidently been suffocated. Had not the child clearly detailed the circumstances, a strong and even a justifiable suspicion of murder might have arisen. In the case of a body found with a plaster covering the mouth and nostrils, or the traces of such having been applied, the witness might be asked, whether this could have been so placed by the individual himself? No such case has ever occurred as an act of suicide; but we are not, therefore, to say it is impossible:—all that we are justified in stating is, that it is a highly improbable mode of self-destruction.

Some singular cases are on record, in which persons have wilfully destroyed themselves by blocking up the throat mechanically. An instance of this form of suicide is reported in the Ed. Med. and Surg. Jour. April 1842. A woman, confined in prison, forced a hard cotton plug into the back of her throat. The cavities of the chest and abdomen had been already examined, and a medical certificate given that the deceased had died of apoplexy! The body was sent to one of the anatomical schools, and on re-inspection, it was then accidentally found that the throat was firmly blocked up with a plug of spindle-cotton. A similar case was the subject of an inquest in London, in September 1843. The deceased here had thrust into her throat a large piece of rag, which had been used in applying a lotion. She speedily died suffocated, and after death the rag was found lodged at the back part of the throat. A case occurred at Maidstone in July 1856, in which a man confined as a prisoner in a cell is reported to have committed suicide by suffocation. He was found lying on his face dead. He had thrown his bed on the floor, had filled his nostrils with pieces of rag, his mouth with a handkerchief, and had tied another handkerchief over his mouth, after which he must have thrown himself down upon his face. The internal organs in these cases present no particular appearances indicative of the kind of death. Such cases are likely to be mistaken for apoplexy, and they certainly show the absolute necessity for a careful examination of the mouth and air-passages in every instance of sudden death. (See Ed. Med. and Surg. Jour. vol. 54. p. 149; also Med.-Chir. Rev. vol. 28. p. 410.)

Homicidal suffocation.—Homicide by suffocation is not very common, although it is a ready means of perpetrating murder. Hitherto, the cases which have come before our Courts of law have been those of infants, of the aged and infirm, and of persons enfeebled by illness. In regard to the latter subjects, the rigorous administration of the law has succeeded in putting a check to this crime: but with respect to children, it probably yet continues. Infanticide by suffocation is most difficult to detect; and, unless the assailant has employed an unnecessary degree of violence, it is probable that the crime may pass altogether unsuspected. One case has been elsewhere reported in which a plug of dough had been forced into the larynx and had caused death. The case of *Reg.* v. *Heywood* (Lancaster Sum. Ass. 1839) proves how easily a defence of apoplexy may be sustained in a case of alleged murder by suffocation.

Homicide by suffocation would not be attempted on healthy adult persons, unless they were in a state of intoxication and thereby rendered defenceless. It is certain that most individuals would have it in their power, unless greatly incapacitated by disease or intoxication, to offer such a degree of resistance as would leave upon their persons indubitable evidence of murderous violence. Death by suffocation may be considered as presumptive of homicide, unless the facts are clearly referable to accident. Accidental suffocation is, however, so palpable from the position of the body and other circumstances, that when death is clearly traced to this cause, it is not easy to conceive a case in which it would be difficult to distinguish it from a case of actual murder. In some instances, the very means that have been adopted to produce suffocation, may forbid the supposition of accident, and clearly establish the fact of homicide.

M. Devergie has reported a case, in which a man was suffocated by having his face forcibly thrust into a heap of corn. A quantity of the corn was found blocking up the mouth and nostrils, and some of the grains had passed into the air-passages (drawn into those parts by forcible inspiration,) as well as into the stomach by swallowing, and even into the duodenum. That violence had been used was proved by the marks of indentations produced by the grains of corn on the face, as well as by excoriations (indicative of resistance) on the hands. The facts were quite inconsistent with the supposition of suicide or accident; yet the jury declined to accept the medical opinion, that the deceased had been homicidally suffocated. (Ann. d'Hyg. 1852, vol. 2. p. 195.) The presence of the grains of corn in the duodenum is not easily to be explained, considering the rapidity of death from suffocation, and that they could not be carried to the small intestine either by aspiration or deglutition. The power of aspiration in the chest is exceedingly great, and drunken or helpless persons may, by falling in the midst of dust, ashes, or other substances, draw a portion of these substances into the air-passages, and thus die by suffocation. In the journal above referred to, M. Devergie mentions the case of a man who fell asleep near some sheaves of corn. He was found dead, and the cause of death was obviously asphyxia. An ear of corn was found fixed in the air-passages.

The suffocation of new-born children, by the introduction of substances into the mouth, is not unfrequent. (See *ante*, INFANTICIDE, p. 488.) The unnecessary force employed generally leaves traces of violence, which may be easily discovered by a careful examination, even should it happen that the substance used for the murderous purpose has been removed. M. Devergie has suggested an objection to evidence founded on a fact of this nature, that the substance might have been introduced after death in order to create a suspicion of infanticide against the mother; but such an objection could hardly be received, since the fact is only one out of many which would be brought against an accused person. According to Devergie, the appearances produced by the introduction of a plug of linen into the mouth *during life*, are these:—the mouth contracting posteriorly, the pressure would be greater in this situation, consequently the blood would be forced out of the compressed mucous membrane of the palate. Anteriorly, the pressure would be less; and here the blood would accumulate, so that the mucous membrane in this situation would become swollen and red. In trusting to these characters, it must be remembered that similar appearances would probably result if the plug were introduced immediately *after death*, as, also, that even when introduced during life, the characters might be lost if the plug were removed from the mouth before the body had entirely cooled.

It is necessary to point out a dangerous practice common among ignorant nurses, which, without exciting suspicion on the part of a coroner or medical witness, may be an occasional cause of death in infants. In order to quiet a child, and to enable a nurse to sleep without disturbance, a bag made of wash-leather or rag, containing sugar, is thrust into the child's mouth. It is thus completely gagged, and the child soon becomes quiet, respiring chiefly through the nostrils. If these by any accident become obstructed, or by the act of respiration the bag should fall to the back of the fauces, death by suffocation must inevitably result,—the infant being perfectly helpless! The suspension of respiration may be so gradual that the child may die without crying or convulsions. The removal of the bag from the mouth will remove every trace of the cause of death: for no pressure is exerted: and in order to exculpate herself, the guilty person may ascribe death to "fits." In one instance, within my knowledge, an infant was timely saved by the mother having discovered, while the nurse was sleeping, a mass of wash-leather projecting from its mouth. The woman awoke, and attempted to remove and conceal the leather, but she was detected in the act. The detection of this abominable practice can only be a matter of pure accident: hence, a fatal case can be rarely the subject of a coroner's inquest, and even then medical evidence may fail to throw any light upon the cause of death. In one instance only have I known it to give rise to a criminal charge. (*Reg.* v. *Cox.* Warwick Lent Assizes, 1848.) The mother, a pauper female, was tried for the attempt to suffocate her infant eleven days old. The child was discovered by another person with a piece of rag hanging from its mouth. It was livid in the face, but when the rag was removed it made a violent gasp, and recovered its breath. There was no malice on the part of the prisoner, but it was made a strong point in her favour that instances had occurred in the workhouse, in which women had with impunity put rags with sugar into the mouths of infants in order to soothe and keep them quiet! The jury acquitted her. The admitted practice of infantile suffocation in the Warwick workhouse appears to have passed without reprimand or even comment, although this plan of soothing infants is just as likely to be fatal to them as that of encircling their necks with ligatures.

Smothering.—Smothering is a variety of suffocation, and consists in the mere covering of the mouth and nostrils in any way so as to prevent the free ingress and egress of air. Like drowning, hanging, or strangulation, it produces death by asphyxia. In new-born infants it is not an unusual occurrence, sometimes originating in accident, and at others in criminal design. An infant may be speedily destroyed by smothering. If the mouth be only lightly covered over with clothing, or slightly compressed, so that respiration is interrupted, as in the act of carrying a child in the arms, this will suffice to cause death; and, as it has been already remarked, death often takes place without being preceded by convulsions or other striking symptoms. Smothering is not often resorted to as a means of perpetrating murder, except in infants, or in debilitated and infirm adults. In a case which occurred at Ayr, a woman was charged with the murder of her child by smothering it in her shawl. She was travelling in a steam-boat: it was a cold stormy day, and she had wrapped the shawl closely round the head of the child. There could be no doubt from the moral circumstances that she had intended to kill it; but the defence was that she had merely intended to protect the child from the cold, and it was suffocated before she was aware of it. There were no facts to exclude this defence, and the woman was acquitted. I have known an instance in this metropolis in which an infant was unintentionally destroyed by the close wrapping of a shawl round its head. In December 1852, Mr. Thornley, of Blyth, Nottinghamshire, consulted me in a case in which an infant was found dead in bed. It was a perfectly healthy child, about three months old. It had been left by the nurse in bed quite well at 6·30 in the morning, when she got up. Soon afterwards the father went into the room and could not see the child; but on removing the bed-clothes it was found beneath them, quite dead, its head covered completely by six folds of clothes. In a quarter of an hour after it had been left by the servant, Mr. Thornley saw the child: it was dead. The body was quite warm (showing recent death), the countenance was calm, the limbs were relaxed: there was a little frothy mucus about the mouth, but nothing to indicate a violent death. There was no doubt, from the circumstances, that the child had been accidentally smothered or suffocated: its body had slipped down beneath the clothes, the mouth and nostrils were covered, and asphyxia speedily came on, which proved fatal, owing to the helplessness of the infant. According to Mr. Wakley, as a result of his experience, infants are frequently found dead owing to their being suckled at night while the woman is in bed. The child's face is pressed on the breast. Mother and child fall fast asleep. The head slips beneath the clothes, and the child is then quietly suffocated. There is no mark of pressure on the bodies. (Lancet, Jan. 16, 1858, p. 69.) A case, apparently of this kind, was communicated to me by Mr. Nason in September 1860. The child (five days old) died quietly on its mother's arm while lying in bed. There was much lividity about the head, neck, and back; but there were no marks of violence. The bronchial tubes of the right lung were completely filled with bright florid blood. The left lung was gorged with blood, but none had escaped. The heart was firmly contracted, and contained but a small quantity of blood in its right cavities.

Certain trials which took place some years since clearly proved that individuals, in a state of intoxication or infirmity, had been murdered by smothering, for the sake of the money derived from the sale of the dead bodies! It will be sufficient to mention the trials of *Burke* and *Macdougall* in Edinburgh, and of *Bishop* and *Williams* in this metropolis, as affording ample evidence of the past existence of this horrible system of secret murder. (See Ed. Med. and Surg. Jour. April 1829, p. 236.) The victims were commonly destroyed by the murderer resting with his whole weight upon the chest, so as to prevent the motion of the ribs, and at the same time forcibly compressing the mouth and nostrils by his hands to prevent the ingress of air. A case of this kind was referred to me for examination in 1831. (*Rex* v. *Elizabeth Ross*, Old Bailey S. Dec. 1831.) It was remarkable for the fact that the prisoner was convicted of homicidal suffocation, although the body of the deceased was never discovered. (See Med. Gaz. vol. 37. p. 481.) In Nov. 1844, a man was convicted at the Assizes of the Seine of the murder of a woman by placing a pitch-plaster over her face. A trial for murder by smothering took place at the Lincoln Lent Assizes, 1843. (The *Queen* v. *Johnson*.) The prisoner, while committing a burglary, tied the deceased to a bed, so that she could not move, and then closely tucked the clothes over her head. After remaining some hours in this condition the deceased died. The prisoner was convicted and executed. For an important case, involving the question of death from homicidal smothering, or from apoplexy, see that of the *Queen* v. *Heywood*, Lancaster Summer Ass. 1839. As an accident, smothering may be conceived to take place when a person falls in a state of intoxication and debility, so that his mouth is in any way covered, or the access of air to the mouth or nostrils is interrupted. On an inspection of the body, the appearances described under the head of asphyxia will be met with in the organs of circulation and respiration: hence in a suspected case of murder we must look for the common indications of asphyxia, and to the circumstances under which the body is found, before we can offer an opinion on the probable cause of death. (For some additional facts connected with this subject, see Ann. d'Hyg. 1837, vol. 2. p. 485.)

CHAPTER 63.

GASEOUS POISONS—MODE OF ACTION—CAUSE OF DEATH MISTAKEN—CARBONIC ACID—SYMPTOMS—APPEARANCES—ANALYSIS—CHARCOAL VAPOUR—ITS EFFECTS—COAL AND COKE VAPOUR—SULPHUROUS ACID—VAPOUR OF LIME- AND BRICK-KILNS—CONFINED AIR—COAL GAS—CARBURETTED HYDROGEN—CARBONIC OXIDE.

Mode of action of gaseous poisons.— In following common language, a medical jurist is compelled to apply the term suffocation to another variety of death; viz. to that of poisoning by *gases*. Physiological accuracy must here be sacrificed, in order that we may make ourselves generally intelligible. Thus, if a person die from the effect of carbonic acid,—of confined air,—of sulphuretted hydrogen, or other noxious gases, he is commonly said to die suffocated. Strictly speaking, he dies poisoned; as much so as if he had taken oxalic or hydrocyanic acid. The only differences are,—1. That the poison, instead of being liquid or solid, is *gaseous*: and—2. Instead of being applied to the mucous membrane of the stomach, it affects that of the *air-cells* of the lungs. In the action of arseniuretted hydrogen, we have a clear instance of poisoning by a gas; and in the respiration of the narcotic vapours of chloroform and ether, we have also illustrations of this form of poisoning. Owing to the fact that the poisonous material is in a finely divided state, and that in the air-cells of the lungs it meets at once with a large absorbing surface, and instantly enters the blood, the effect is more rapid, and, *cæteris paribus*, more powerful. It has been remarked, too, that some, and probably all these aerial poisons, have an accumulative action; *i. e.* their effect continues to increase for a short period, even after a person has ceased to respire them.

The cause of death mistaken.—The greater number of the poisonous gases are chiefly complex products of art, and are never likely to be met with in the atmosphere so abundantly as to produce injurious consequences:—hence fatal accidents, arising from their inhalation, most commonly occur under circumstances which can leave no question respecting the real cause of death. The peculiar effects of all of these it will not be necessary to describe in this place; but there are two, a knowledge of the properties and operations of which may, on certain occasions, be required of a medical jurist:—these are, the CARBONIC ACID and SULPHURETTED HYDROGEN GASES. Agents of this description can rarely be employed with any certainty as instruments of murder; and if they were so employed, the fact could be established only by circumstantial evidence. One alleged instance of murder by carbonic acid is, however, reported by M. Devergie. (Ann. d'Hyg. 1837, vol. 1. p. 201.) Death, when arising from the respiration of any of the gases, is generally attributable to suicide or accident. In France it is by no means uncommon for individuals to commit self-destruction by sleeping in a closed apartment, in which charcoal has been suffered to burn; while in England accidental deaths are sometimes heard of, where coal has been employed as fuel in small and ill-ventilated rooms. On such occasions a person may be found dead without any apparent cause to the casual observer,—the face may appear swollen and discoloured, and the skin may be covered with ecchymosed patches. The discovery of a body under these circumstances will commonly be sufficient, in the eyes of the vulgar, to create a suspicion of murder; and some person, with whom the deceased may have been at that period on bad terms, will, perhaps, be pointed out as the murderer. In such a case, it is obvious that the establishment of the innocence of an accused party may depend entirely on the discrimination and judgment of a medical practitioner. An instance, illustrative of the consequences of this popular prejudice, occurred in London in 1823. Six persons were lodging in the same apartment, where they were all in the habit of sleeping. One morning an alarm was given by one of them, a female, who stated that on rising she found her companions dead. Four were discovered to be really dead, but the fifth, a married man, whose wife was one of the victims, was recovering. He was known to have been on intimate terms with the female who gave the alarm, and it was immediately supposed that they had conspired together to destroy the whole party, in order to get rid of the wife. The woman who was accused of the crime was imprisoned; and an account of the supposed barbarous murder was soon printed and circulated in the metropolis. Many articles of food about the house were analysed, in order to discover whether they contained poison, when the whole of the circumstances were explained by the man stating that he had placed a pan of burning coals between the two beds before going to sleep, and that the doors and windows of the apartment were closed.

(Christison, 583.) A set of cases of a similar kind, in which there was at first a strong suspicion of poisoning, has been reported in the Medical Gazette, by Mr. Smith, of Liverpool (vol. 36. p. 937).

CARBONIC ACID.

Symptoms.—The symptoms of poisoning by this gas will vary according to the degree of concentration in which it is present in the atmosphere respired. When it exists in a fatal proportion, the symptoms commonly observed are as follows:—A sensation of great weight in the head, giddiness, a sense of constriction in the temporal regions, a ringing in the ears with a pungent sensation in the nose; a strong tendency to sleep, accompanied by vertigo, and so great a loss of muscular power, that, if the individual be at the time in an erect posture, he instantly falls as if struck to the ground. The respiration, which is observed to be at first difficult and stertorous (snoring), becomes suspended. The action of the heart, which on the first accession of the symptoms is very violent, soon ceases. Sensibility is lost, and the person now falls into a profound coma, or state of apparent death. The warmth of the body still continues; the limbs remain flexible, but they have been observed to become rigid or even occasionally convulsed. The countenance is commonly of a livid or of a deep leaden colour, especially the eyelids and lips, but on some occasions it is stated to have been pale. The access of these symptoms is stated to have been sometimes accompanied by a pleasing sensation of delirium, while at others the most acute pains have been suffered. In some instances there appears to have been irritability of the stomach; for the affected person has vomited the contents of his stomach in a semi-digested state. Those who have been resuscitated have often felt pain in the head, or pain and soreness over the body, for several days; while, in a few severe cases, paralysis of the muscles of the face has supervened on recovery.

Appearances after death.—Externally, the whole of the body appears as if it were swollen, especially the face, which is generally livid, and the features are much distorted. The skin is covered in parts by patches of a violet hue, but, in some instances, the skin has been extremely pale; the eyes are generally prominent, and, in many cases, retain their usual brilliancy some time after death. The body of a person who has perished from the inhalation of carbonic acid is said to retain the animal heat, *cæteris paribus*, for a longer period than usual; and hence, according to Orfila, cadaveric rigidity does not commonly manifest itself until after the lapse of many hours. In a case to be related presently, the body was, however, found to have cooled considerably within the short space of two hours. On inspection, the venous system is found filled with liquid blood of a dark colour; and the vessels of the lungs and brain are observed to be especially in a state of congestion. The tongue appears swollen, and it is stated by Orfila that the mucous membrane of the intestinal canal is often interspersed with dark ecchymosed patches. The following appearances were met with thirty hours after death in the bodies of two adults, male and female, who died from the accidental introduction of carbonic acid from burning ashes, into their bed-room. Externally there was nothing unnatural, excepting a few slight discolorations on the back of the man. Internally there was congestion of the membranes and great vessels of the brain. Each lateral ventricle contained about half an ounce of clear serum. The lungs were gorged with dark blood: and the lining membrane of the air-tubes (bronchi) was slightly reddened. The left sides of the hearts were nearly empty: the right contained a quantity of dark half-coagulated blood. The stomachs were healthy. The bodies were found on the floor of the bed-room in easy positions. The deceased had had the power to get out of bed, but were unable to escape from the chamber. It will be perceived from this description that there is nothing very characteristic in the appearances, and thus it is always easy to ascribe death to apoplexy or some other cause; but it should be remembered that carbonic acid itself acts by inducing apoplexy or cerebral congestion.

The following singular case of death from carbonic acid was communicated to me by Mr. Procter, of York. The deceased, an old woman, occupied a room under one in which there was a quantity of nitric acid kept in store. Owing to some accident a carboy was broken—the acid ran through the ceiling into the room below, acting upon and corroding the bed-coverings of the deceased's bed. As the room was quite filled with the nitric acid fumes, a chemist was consulted, and he advised that whiting should be freely used for the purpose of neutralizing the acid. This advice was followed, and several persons who were in the room witnessing the operation, felt oppressed and were obliged to leave it. They were observed to stagger, as if intoxicated, on reaching the street. The room was then completely closed, and the whiting allowed to remain in contact with the acid. The deceased had suffered from diarrhœa for a few days previously, and was obliged to resort to the night-chair, which was in the room in which the accident had occurred. As she remained absent half an hour, some persons entered the apartment and found her in the chair unable to move. She was taken into another room, and on a medical man being called to her, he found her sleepy and comatose—her mind confused,—there was great difficulty of breathing,—extreme lividity of the face and lips,—the arms and legs were cold, and the pulse was full. In spite of efforts made to save her, she died in about an hour from the time at which she had entered the room. Those who found her in the apartment do not appear to have suffered. This was a case of slow poisoning by carbonic acid, for no carbonic oxide could have been evolved from the action of the acid in the chalk. Age, and debility from previous illness, may account for the unusual circumstance that the deceased did not recover on being removed to a pure atmosphere.

Analysis.— Sometimes a medical jurist may be required to state, for the purposes of justice, the nature of the gaseous mixture in which a person may have died. He will have but little difficulty in determining whether carbonic acid is or is not the deleterious agent in such a mixture. When it exists in a confined atmosphere, its presence may be identified, if previously collected in a proper vessel, by the following characters. 1. It extinguishes a taper if the proportion be above twelve or fifteen per cent; and, from the extreme density of the gas, the smoke of the extinguished taper may be commonly seen to float on its surface. 2. Lime-water, or a solution of subacetate of lead, is instantly precipitated white when poured into a jar of the gas; and the precipitate thus formed may be collected by filtration, and proved to possess the well-known properties of carbonate of lime or lead. Air containing only one per cent. of carbonic acid scarcely affects lime-water. The *proportion* in which carbonic acid exists in a mixture, may be determined by introducing into a measured quantity, in a graduated tube over mercury, a strong solution of potash. Absorption will take place after a certain time, and the degree of absorption will indicate the proportion of carbonic acid present. When this destructive agent exists in a confined spot, as in a well or cellar, it may be generally got rid of by placing within the stratum a pan containing the hydrate of lime, loosely mixed into a paste with water;—by exciting combustion at the mouth of the pit; or what is better, when available, by a jet of high-pressure steam. Lives are often successively lost on these occasions in consequence of one person descending after another, in the foolish expectation of at least being able to attach a rope to the body of his companion. The moment that the mouth comes within the level of the stratum, all power is lost, and the person commonly sinks lifeless. The gas may be collected by lowering a bottle filled with fine sand by means of a string attached to the neck, and guiding the bottle by another string attached to its base. When the bottle is within the stratum, it should be turned with its mouth downwards; and, when the sand has fallen out, it may be rapidly raised with its mouth upwards, by pulling the string attached to the neck.

CHARCOAL-VAPOUR.

Products of burning charcoal.—The gas extricated during the combustion of charcoal, according to the experiments of Orfila, is not pure carbonic acid, but a mixture of gases. It operates fatally when respired, chiefly in consequence of the carbonic acid contained in it: the proportion of this gas is, however, subject to variation.

Symptoms and appearances after death.—The following case, illustrating the effects of charcoal vapour, has been reported by Mr. Collambell. (Med. Gaz. vol. 27. p. 693.) In January 1841, a man was engaged to clean the windows of three small rooms on the basement-story of a house. The first room had a door opening into a courtyard, the others merely communicated with each other by a central door, and there was no fireplace in any one. A brazier of burning charcoal had been placed in the outer room for the purpose of drying it, but it appeared that the deceased had shut the outer door, and had removed the brazier into the inner room of the three, leaving the communicating doors open. In *two hours* the man was found quite dead, lying on the floor of the middle room. The countenance was pale, as well as the whole of the skin: the eyes were bright and staring, the pupils widely dilated; the lips bloodless; the jaw firmly fixed; the tongue protruding; and the face and the limbs were cold. Some frothy mucus had escaped from the mouth. The person who discovered the deceased found the ashes in the brazier still burning, and he experienced great oppression in breathing. An inquest was held without an inspection, and a verdict of accidental death returned. The body was afterwards privately inspected by Mr. Collambell. On opening the head, the vessels on the surface of the brain were found highly distended with dark liquid blood; the pia mater was bedewed with serum. The brain was of unusually firm consistence, and numerous bloody points appeared on making a section of it. The lateral ventricles were distended with about an ounce and a half of pale serum, and the vessels of the plexus choroides were much congested. The cerebellum was firm, and presented on section numerous bloody points. About two ounces of serum, tinged with blood, were collected from the base of the skull. The lungs had a slate colour. On the left side of the chest there were eight ounces of serum, tinged with blood, and nearly an equal quantity on the right side. On cutting into the organs, a large quantity of serous fluid, mixed with blood, escaped. The bronchial tubes were filled with a frothy fluid tinged with blood. The pericardium contained an ounce of pale serum: the heart was enlarged,—its cavities contained no blood: the liver and kidneys were, however, much gorged. There was no doubt that the cause of death was the inhalation of charcoal-vapour; and it is probable that the man died from respiring but a comparatively small proportion. The capacity of the chambers must have nearly reached two thousand cubic feet; the deceased had been there only two hours, and, when the person who discovered him entered the rooms, the air was not so vitiated but that he could breathe, although with some oppression. The fuel was then in a state of combustion. In a case which was referred to me for examination in 1851, there was a considerable effusion of blood in the submucous tissue of the stomach. This appearance led to a strong suspicion of irritant poisoning. A full investigation of the circumstances, however, showed that the suspicion was unfounded. Carbonic acid had descended through a flue communicating with the bed-room in which deceased slept with her husband: it destroyed the wife and nearly killed the husband. A stove with burning charcoal had been placed in the room above that in which the couple slept, and an iron pipe conveyed the products of combustion into a flue whence they descended into the bed-room and caused the fatal accident. In one fatal case there was copious bleeding from the nose. (Med. Gaz. vol. 47. p. 412.) A remarkable case of the effects produced by the products of combustion is reported by Mr. J. B. Thompson, Ed. Month. Jour. 1860, vol. 1. p. 642.

Power of locomotion.—It often excites surprise on these occasions that no exertion is made to escape, when it would apparently require but very slight efforts on the part of the individual. The fact is that the action of the vapour is sometimes very insidious; one of its first effects is to create an utter prostration of strength, so that even on a person awake and active, as in the case above related, the gas may speedily produce a perfect inability to move or to call for assistance. For some remarks on the action of charcoal-vapour by Dr. Bird, see Guy's Hospital Reports, April 1839; and for a case illustrative of the dangerous effects of the diluted vapour, see Ed. Med. and Sur. Journ. vol. 1. p. 541. In this instance, a charcoal brazier was left only for a short time in the cell of a prison. It was removed, and the prisoners went to sleep. They experienced no particular effects at first, but after some hours two were found dead. Thus, then, an atmosphere which can be breathed for a short time with impunity may ultimately destroy life.

COAL- AND COKE-VAPOUR. SULPHUROUS ACID.

Products from burning coal and coke.—The gases extricated in the smothered combustion of coal or coke are of a compound nature. In addition to carbonic acid, we may expect to find in the atmosphere of a close room, in which such a combustion has been going on, SULPHUROUS ACID GAS, and from coal, in addition to this, the sulphuretted and carburetted hydrogen gases. These emanations are equally fatal to life; but in consequence of their very irritating properties, they give warning of their presence, and are therefore less liable to occasion fatal accidents. From an accident which occurred at Colchester a few years since, in which two children lost their lives, it would appear that some persons are so ignorant as to believe that the vapour of coke is less fatal than the vapour of charcoal. The sulphurous acid gas, when existing in a small proportion in air, has the effect of irritating the air-passages so violently, that, if accidentally respired, it would commonly compel the person to leave the spot before the vapours had become sufficiently concentrated to destroy life. Nevertheless, accidents from the combustion of coal and coke sometimes occur.

Symptoms and appearances.—The following cases will convey a knowledge of the symptoms and appearances which are commonly met with on these occasions. Some years since four persons, in a state of asphyxia, were brought to Guy's Hospital. It appeared that on the previous evening they had shut themselves up in the forecastle of a coal-brig, and had made a fire. About six or seven o'clock on the same evening some of the crew accidentally placed a covering over the flue on the outside, and thus stopped the escape of smoke from the fire, which was made of a kind of coal containing much sulphur. Early in the morning one of the crew, on opening the hatches, observed three of the inmates lying on the floor senseless and frothing at the mouth; the fourth in his crib, in a similar condition. The air in the place was most offensive. After the men were brought on deck, one of them, aged twenty-one, began to recover, and when brought to the hospital he seemed only giddy, as if intoxicated. He soon completely recovered. Another, aged forty, after breathing oxygen gas and having brandy and ammonia exhibited to him, showed no symptoms of recovery, but died in a few hours. A third, aged seventeen, soon began to rally, and in a few hours was perfectly enabled to answer questions; he declared that he felt no pain, sense of oppression or weight, either in his head or chest. The fourth, aged fifteen, died the following day, having exhibited no symptoms of rallying. Stimulants were administered internally, and warm fomentations were used, but all efforts to produce reaction failed. The appearance of these persons when brought in was as follows:—lips purple, countenance livid, surface of the body cold, hands and nails purple, respiration quick and short; pulse small, quick, and feeble; the pupils were fixed, and there was total insensibility. The body of the man aged forty was inspected four hours after death. The membranes of the brain were congested, and there was a large quantity of fluid under the tunica arachnoides. The sinuses were gorged with blood. The lungs were in a state of great congestion, as also the right cavities of the heart. It was remarked that this corpse was similar in appearance to that of an executed culprit. The body of the lad aged fifteen was inspected about thirty-three hours after death. Under the pia mater was observed one small ecchymosed spot; in the substance of the brain there were more bloody points than usual; a small quantity of fluid was found under the tunica arachnoides, and the sinuses were full of coagulated blood. The lungs showed no congestion, but the right cavities of the heart were much distended with blood. (For a report of cases of recovery from the effects of coal-vapour, see Med. Gaz. vol. 9. p. 935; also Dub. Med. Press, Jan. 31, 1849, p. 69, and Med. Gaz. vol. 43. p. 937.)

A case showing the fatal effects of coal-vapour has been published by Dr. Davidson. The man lost his life from sleeping in a closed room with a fire to which there was no flue. The lungs were found gorged with blood, and the trachea and bronchi were filled with a frothy muco-sanguineous fluid; the mucous membrane beneath was slightly injected There was a small effusion in each pleural cavity. The right side of the heart was full of dark liquid blood. The dura mater was much injected; the sinuses of the brain and the veins of the pia mater were completely congested, and there was sub-arachnoid effusion. The substance of the brain, when cut, presented numerous bloody points. (Month. Jour. April 1847, 763.) In the Medical Times and Gazette (April 3, 1852, p. 353) the reader will find an account of three cases of recovery from the effects of coal vapour. (See also for other cases which proved fatal, the same journal, March 31, 1860, p. 323.)

Analysis.— Sulphurous acid is immediately known by its powerful and suffocating odour, which resembles that of burning sulphur. The best test for its presence is a mixture of iodic acid and starch, which speedily acquires a blue colour when exposed to the vapour.

VAPOUR OF LIME- AND BRICK-KILNS.

Gaseous products from lime-burning.—In the burning of lime, carbonic acid is given out abundantly in a pure form. It has been owing to the respiration of the gas thus extricated that persons who have incautiously slept in the neighbourhood of a burning lime-kiln during a winter's night have been destroyed. The discovery of a dead body in such a situation would commonly suffice to demonstrate the real cause of death; but a practitioner ought not to be the less prepared to show that there existed no other apparent cause of death about the person. It is obvious that a person might be murdered, and the body placed subsequently near a kiln by the murderer, in order to avert suspicion. If there be no external marks of violence, the stomach should be carefully examined for poison; in the absence of all external and internal lesions, medical evidence will avail but little; for a person might be criminally suffocated, and his body, if found under the circumstances above stated, would present no appearances upon which a medical opinion could be securely based. An accident is related by Foderé to have occurred at Marseilles, in which seven persons of a family were destroyed in consequence of their having slept on the ground-floor of a house, in the courtyard of which a quantity of limestone was being burnt into lime. They had evidently become alarmed, and had attempted to escape; for their bodies were found lying in various positions. The courtyard was enclosed, and the carbonic acid had poured into the apartment through the imperfectly closed window and door. In November 1838, a man died three days after being exposed to the vapours of a lime-kiln. (Guy's Hosp. Rep. April 1839.) The vapour of a brick-kiln is equally deleterious, the principal agent being carbonic acid, although I have found that ammonia and hydrochloric acid are also abundantly evolved. In September 1842, two boys were found dead on a brick-kiln near London, whither they had gone for the purpose of roasting potatoes. Although the cause of death in the two cases was clearly suffocation, in one instance the body was extremely livid, while in the other there was no lividity whatever! Such accidents are very frequent. In November 1844, an inquest was held at Manchester on the body of a man who had died under similar circumstances.

CONFINED AIR.

Symptoms and effects.—An animal confined within a certain quantity of air which it is compelled to respire, will soon fall into a state of lifelessness. A human being in the same way may be suffocated, if confined in a close apartment where the air is not subject to change or renewal, and this effect is hastened when a number of persons are crowded together in a small space. The change which air, thus contaminated by respiration, undergoes, may be very simply stated. The quantity of nitrogen in a hundred parts will remain nearly the same: the quantity of oxygen will probably vary from eight to twelve per cent. while the remainder will be made up chiefly of carbonic acid. Such air will also have a high temperature if many persons are crowded together, and will be saturated with aqueous vapour containing animal matter poured out by the pulmonary and cutaneous exhalants. From this statement, it is evident that air which has been contaminated by continued respiration will operate fatally on the human system, partly in consequence of its being deficient in oxygen, and partly from the deleterious effects of the carbonic acid contained in it. The proportion in which carbonic acid exists in respired air, is subject to great variation; according to the experiments of Allen and Pepys, it never exceeds ten per cent. by volume of the mixture, how frequently soever it may have been received into and expelled from the lungs. Dalton found that the air in crowded rooms contained about one per cent. of carbonic acid, the atmospheric proportion being therefore increased nearly twenty-fold. It is certain that insensibility and death would ensue in a human adult, before the whole of the oxygen of the confined air had disappeared; but the opportunity can rarely present itself of analyzing such a contaminated mixture, and hence it is impossible to specify the exact proportion in which carbonic acid would exist, when the confined air proved fatal to persons who had respired it. M. Lassaigne has shown by direct experiment, that the carbonic acid in the air of close rooms is not collected on the floor, but equally diffused throughout. The whole mass of air is in fact vitiated, and requires renewal. (Med. Gaz. vol. 38. p. 351.)

COAL-GAS. CARBURETTED HYDROGEN. CARBONIC OXIDE.

Since the introduction of coal-gas for the purpose of illumination, many fatal accidents have occurred from the respiration of air contaminated with it. Coal-gas is a compound body, acting as a direct poison when respired. Its composition is subject to much variation, according to circumstances. Mitscherlich found that it was principally composed of light carburetted hydrogen, hydrogen, and carbonic oxide, in the proportions of 66 per cent. of the first, 21·3 of the second, and 11 of the third. M. Tourdes found that the proportions of light carburetted hydrogen and carbonic oxide were nearly equal, *i. e.* about 22 per cent. The difference in composition depends on the heat to which the gas has been submitted. Some consider that CARBONIC OXIDE is the poisonous principle; but there is no doubt that the hydrocarbons also have a noxious influence, although the use of the safety-lamp in mines proves that a mixture of light carburetted hydrogen with air in a small proportion may be respired without producing serious effects.

Symptoms and appearances after death.—The symptoms produced by coal-gas, when mixed in a large proportion with air, are, giddiness, headache, nausea with vomiting, confusion of intellect with loss of consciousness, general weakness and depression, partial paralysis, convulsions, and the usual phenomena of asphyxia. The appearances after death will be understood from the following cases. In January 1841, a family residing at Strasburg respired for forty hours an atmosphere contaminated with coal-gas which had escaped from a pipe passing near the cellar of the house in which they lodged. On the discovery of the accident, four of the family were found dead. The father and mother still breathed; but, in spite of treatment, the father died in twenty-four hours: the mother recovered. On an inspection of the five bodies there was a great difference in the appearances; but the principal points observed were, congestion of the brain and its membranes, the pia mater gorged with blood, and the whole surface of the brain intensely red. In three of the cases there was an effusion of coagulated blood on the dura mater and spinal canal. The lining membrane of the air-passages was strongly injected, and there was spread over it a thick viscid froth tinged with blood; the substance of the lungs was of a bright red colour, and the blood was coagulated. (Ann. d'Hyg. Jan. 1842.) In two cases communicated by Mr. Teale to the Guy's Hospital Reports (No. 8.), there was found congestion of the brain and its membranes, with injection of the lining membrane of the air-passages. In these cases the blood was remarkably liquid. The circumstances under which the accident occurred were very similar. An aged female and her grand-daughter, who had been annoyed by the escape of gas during the day, retired to bed; and were found dead about twelve hours afterwards.

In the cases above given, the effects produced by coal-gas were owing to the long-continued respiration of it in a diluted state. The quantity contained in the air of the rooms must have been very small; in M. Tourdes' case it was probably not more than 8 or 9 per cent, because at a little above this proportion the mixture with air becomes explosive, and there had been no explosion in this case, although in the apartment in which the individuals were found dead, a stove had been for a long time in active combustion, and a candle had been completely burnt out. In Mr. Teale's case those who entered the house perceived a strong smell of coal-gas; but still the air could be breathed. Coal-gas, therefore, like other aerial poisons, may destroy life if long respired, although so diluted as not to produce any serious effects in the first instance! This gas owes its peculiar odour to the vapour of naphtha: the odour begins to be perceptible in air when the gas forms only the 1000th part; it is easily perceived when forming the 700th part, but the odour is well marked when it forms the 150th part (Tourdes). In most houses in which gas is burnt, the odour is plainly perceived; and it is a serious question whether health and life may not often be affected by the long-continued respiration of an atmosphere containing but a small proportion. The odour will always convey a sufficient warning against its poisonous effects. It should be known that this gas will penetrate into dwellings in an insidious manner. In Mr. Teale's cases, the pipe from which the gas had escaped was situated about ten feet from the wall of the bed-room where the females slept. The gas had permeated through the loose earth and rubbish, and entered the apartment through the floor! It is impossible to determine exactly what proportion of this gas in air will destroy life. An atmosphere containing from 7 to 12 per cent. has been found to destroy dogs and rabbits in a few minutes: when the proportion was from 1½ to 2 per cent. it had little or no effect. With respect to man, it may destroy life if long respired when forming about 9 per cent. *i. e.* when it is in less than an explosive proportion. (See B. and F. Med. Rev. vol. 20. p. 253; also, Ann. d'Hyg. 1830, vol. 1. p. 457.)

M. Tourdes has ascertained that rabbits died in twenty-three minutes, when kept in an atmosphere containing 1-15th of its bulk of pure *carbonic oxide.* When the proportion was 1-30th, they died in thirty-seven minutes, and when 1-8th, in seven minutes. The action of the gas on the body is that of a pure narcotic: it appears to be a powerful poison.

Analysis.—The circumstances under which the accident occurs will generally suffice to establish the nature of the gas. Coal-gas burns with a bright white light, producing carbonic acid and water. A taper should be cautiously applied to a small quantity; since, when the gas is mixed with the air in the proportion of from 11 to 14 per cent. it is dangerously explosive. For this reason no lighted candle should be taken into an apartment where an accident has occurred, until all the doors and windows have been for some time kept open, and the smell of gas has entirely disappeared. (See Med Gaz. vol. 42. p. 343.) The combustion of the gas, or its explosion with air, is a sufficient test of its nature; the peculiar odour, and the want of action on a salt of lead, will distinguish it from sulphuretted hydrogen.

Carbonic oxide is known by the fact that when kindled it burns with a pale blue light, and produces carbonic acid and water by its combustion.

CHAPTER 64.

SULPHURETTED HYDROGEN GAS—SYMPTOMS—APPEARANCES.—EFFLUVIA OF DRAINS AND SEWERS—ANALYSIS.—EXHALATIONS OF THE DEAD.

Sulphuretted Hydrogen. *Symptoms.*—The symptoms produced by sulphuretted hydrogen on the human system vary according to the degree of concentration in which it is respired. When breathed in a moderately diluted state, the person speedily falls inanimate. An immediate removal to pure air, bleeding, and the application of stimulants, with cold affusion, may, however, suffice to restore life. According to the account given by those who have recovered, this state of inanimation is preceded by a sense of weight in the stomach and in the region of the temples; also by giddiness, nausea, sudden weakness, and loss of motion and sensation. If the gas in a still less concentrated state can be respired for some time, coma (insensibility), or tetanus with delirium, supervenes, preceded by convulsions or pain and weakness over the whole of the body. The skin in such cases is commonly cold, the pulse irregular, and the respiration laborious. When the air is but slightly contaminated by the gas, it may be breathed for a longer time without producing any serious symptoms; there is a feeling of nausea, or sickness, with loss of appetite, great bodily weakness, accompanied by pain in the head, or diffused pains in the abdomen. These symptoms occasionally affect those who are engaged in chemical manipulations with this gas.

In all cases a noxious atmosphere containing this gas is indicated by a foul smell producing nausea or sickness. The following may be taken as a good example of the effects of slow poisoning by the diluted gas. The men who were engaged in working at the Thames Tunnel suffered severely during the excavation, from the presence of this gas in the atmosphere in which they were obliged to work. The case was referred to me for examination by Sir I. M. Brunel, in 1839. The air, as well as the water which trickled through the roof, was found to contain sulphuretted hydrogen: it was probably derived from the action of the water on the iron-pyrites in the clay. The gas issued in sudden bursts, so as to be at times perceptible by its odour. By respiring this atmosphere, the strongest and most robust men were, in the course of a few months, reduced to an extreme state of exhaustion, and several died. The symptoms with which they were first affected were giddiness, sickness, and general weakness; they became emaciated, and fell into a state of low fever, accompanied by delirium. In one case which I saw, the face of the man was pale, the lips were of a violet hue, the eyes sunk, with dark areolæ around them, and the whole muscular system flabby and emaciated. Chloride of lime and other remedies were tried for the purification of the air; but the evil did not entirely cease until the tunnel was so far completed that there was a communication from one side to the other, and free ventilation throughout.

Sulphuretted hydrogen appears to act like a narcotic poison when highly concentrated: but like a narcotico-irritant when much diluted with air. It is *absorbed* into the blood, to which it gives a brownish-black colour, and it is in this state circulated throughout the body. (For the report of a case of poisoning by this gas, in which the person recovered, see Medical Gazette, vol. 48. p. 871.)

Appearances after death.—On examining the bodies of persons who have died from the effects of sulphuretted hydrogen, when respired in a concentrated form, and the inspection is recent, the following appearances have been observed. The mucous membrane of the nose and fauces is commonly covered by a brownish viscid fluid. An offensive odour is exhaled from all the cavities and soft parts of the body. These exhalations, if received into the lungs of those engaged in making the inspection, sometimes give rise to nausea and other unpleasant symptoms, and may even cause syncope or asphyxia. The muscles of the body are of a dark colour, and are not susceptible of the galvanic stimulus. The lungs, liver, and the soft organs generally, are distended with black liquid blood. There is also great congestion about the right side of the heart, and the blood is said to be everywhere dark-coloured, and not to become coagulated after death: the body rapidly undergoes the putrefactive process. When death has occurred from the respiration of this gas in a more diluted form, these appearances are less marked. There is then general congestion of the internal organs, with a dark and liquid state of the blood. In fact, in such cases the appearances can scarcely be distinguished from those produced by carbonic acid. Four men lost their lives in the Fleet Lane Sewer in February 1861. They were found dead, and there was no doubt that sulphuretted hydrogen was the cause of death. An account of the appearances presented by the bodies is given in the Lancet by Mr. Holden and Dr. Letheby (February 23, 1861, p. 187). The eyes and mouth were open, the lips and tongue livid, the pupils widely dilated, the blood black and fluid, the lungs congested, the heart full of black fluid blood, the right side gorged, and there was bloody froth in the trachea. In the brain the large vessels of the dura mater were full of black fluid blood.

In June 1857, six persons lost their lives at *Cleator Moor*, near Whitehaven, by the respiration of this gas in a diluted form, by reason of their having slept in small close, ill-ventilated rooms, into which sulphuretted hydrogen had penetrated. Three of the deceased persons, a husband, wife, and child, of one family (*Armstrong*), had retired to rest in their usual health, on the night of the 9th of June. Two of them were found the next morning dead in bed, and a third (the child) was found in a state of insensibility, and lingered until the afternoon of the same day, when she died. The fourth, a healthy adult, retired to sleep in his bed, with the door closed, and he was found dead in *an hour*. The fifth, a child, was taken ill on the morning of the 11th, and died the same day. The sixth was taken ill on the morning of the 10th, and died on the 12th of June.

The symptoms complained of by some who recovered were nausea, sickness, giddiness, and insensibility. On inspection of the body of one child, the pupils were found dilated,—viscid mucus escaped from the nostrils,—there was congestion of the lungs and kidneys, as well as of the membranes of the brain. In the adult who died in an hour, the pupils were natural,—the jaws firmly clenched, the fingers contracted,—nails blue,—there was great cadaveric lividity, and a quantity of fluid with frothy mucus issued from the nostrils and mouth. The lungs were much congested, and there was a quantity of serum effused in the cavity of the chest. The heart contained a little fluid blood, and was somewhat flaccid. The membrane of the windpipe and gullet was redder than natural. In the windpipe there was frothy mucus. The stomach, and large and small intestines, were highly congested, but otherwise healthy. The brain and its membranes were greatly engorged with blood, which, as in the body generally, was very dark and fluid. Mr. J. B. Wilson, who examined the body of the child, drew the conclusion, which was confirmed by the subsequent inquiry, that death had been caused by sulphuretted hydrogen. Dr. Thompson, who examined the body of the man, inferred that some noxious gas or gases had destroyed life. Having been required by the Home Office to investigate the cause of death in these cases, I visited Cleator on the 22nd of June, and found that the cottages in which the accidents had occurred were built upon a heap of iron-slag, which also abutted on the premises behind. This slag contained among other matters sulphide of iron and sulphide of calcium. A foul smell, compared to that of cinders extinguished by water, had for some time been perceived about the rooms, chiefly at night, when the doors and windows were closed; and the day before the occurrence, a heavy storm of rain had washed through the slag-heap, and aggravated the effects. The heap of slag was burning in certain parts, and sulphuretted hydrogen was evolved in large quantities at a depth of a few feet below. At this time, *i. e.* a fortnight after the deaths, on removing the flags in the lower rooms, the slag below was found damp, and sulphuretted hydrogen was still issuing from it. The lead paint in the closets was partly converted to black sulphuret, and this chemical change was found in patches on the chamber door of one room in which two persons had died.

The symptoms, so far as they were observed, in the living, the appearances in the dead bodies, and the chemical nature of the wet slag beneath the foundation, left no reasonable doubt that during the night, with the doors and windows closed, sulphuretted hydrogen had escaped in sufficient quantity to poison the air and destroy life, and a verdict was returned to that effect. A suggestion was made that carbonic acid might have caused the symptoms and death:—but there was no source of carbonic acid but the breath; and there is, I believe, no instance known of any adult having breathed himself to death in an hour, in a room containing 600 cubic feet of air,—not to mention that persons had slept in similar rooms in the same row of cottages, at a distance from the slag-heap, without perishing from such a cause. It is highly probable that the sulphuretted hydrogen was mixed with other gases and vapours, as it is never found pure except in a chemical laboratory: but it was no doubt here the agent of death.

In these cases, as in poisoning by carbonic acid, an atmosphere which may be breathed for a short time with impunity will ultimately destroy life. Sulphuretted hydrogen in a fatal proportion, however diluted or mixed with other vapours, would always be indicated by a disagreeable smell,—although from habit, as well as probably from the effects of the gas on the nervous system, this offensive smell might not be perceived when a person had remained for a short time in the poisoned atmosphere. In the cases of the *Halls*, which occurred at Sheffield in 1852, there is reason to believe that the deaths of two persons were caused by the smouldering of ashes in a cesspool. (Association Medical Journal, April 1853, p. 280.) Mr. Haywood considered that carbonic acid was the agent in this case, although it is probable, from the nature of the materials in which combustion was going on, that other gases and vapours were simultaneously evolved.

Effluvia of drains and sewers.—The most common form of accidental poisoning by sulphuretted hydrogen, for it is rare that a case occurs which is not purely accidental, is witnessed among nightmen and others who are engaged in cleaning out drains and sewers, or in the removal of the soil of privies. These accidents are much more frequent in France than in England, the soil being often allowed to collect in such quantities in Paris and other large Continental cities, as to render the removal of it a highly dangerous occupation for the workmen. According to the results of Thénard's observations, there are two species of compound gases, or mechanical mixtures of gases, which are commonly met with in the exhalations of privies. The first compound consists of a large proportion of atmospheric air holding diffused through it, in the form of vapour, the *hydrosulphate of ammonia*. The hydrosulphate is contained abundantly in the water of the soil, and is constantly rising from it in vapour, and diffusing itself in the surrounding atmosphere. It is this vapour which gives the highly unpleasant odour, and causes an increased secretion of tears in those who unguardedly expose themselve to such exhalations. The *symptoms* produced by the respiration of this gaseous mixture, when in a concentrated state, bear a close resemblance to those which result from the action of sulphuretted hydrogen gas. If a person is but slightly affected, he will probably complain of nausea and sickness: his skin will be cold, his respiration free but irregular; the pulse is commonly frequent, and the voluntary muscles, especially those of the chest, are affected by spasmodic twitchings. If more seriously affected, he loses all power of sense and motion, the skin becomes cold, the lips and face assume a violet hue, the mouth is covered by a bloody and frothy mucus; the pulse is small, frequent and irregular; the respiration hurried, laborious, and convulsive; and the limbs and trunk are in a state of general relaxation. If still more severely affected, death may take place immediately; or should the person survive a few hours, in addition to the above symptoms there will be short but violent spasmodic twitchings of the muscles, sometimes even accompanied by opisthotonos. (See Ann. d'Hyg. 1829, vol. 2. p. 70.) If the person is sensible, he will commonly suffer the most severe pain, and the pulse may become so quick and irregular that it cannot be counted. When the symptoms are of such a formidable nature, it is rare that a recovery takes place. The *appearances* met with on making an examination of the body are similar to those observed in death from sulphuretted hydrogen. The inspection should be made with caution; for a too frequent respiration of the poisonous exhalations may seriously affect those who make it.

A singular accident occurred in this metropolis in August 1847, in which a man lost his life by the evolution of a quantity of sulphuretted hydrogen from a foul drain. It appears that shortly before the accident, a large quantity of oil of vitriol had been poured down the drain communicating with the privy. The deceased entered the yard, and was soon afterwards found on the pavement in a dying state. On inspection of the body, the brain was healthy; but the lungs were gorged with blood, which had the offensive odour of sulphuretted hydrogen gas. The medical witness referred death to this gas, and stated that lime had been thrown into the drain, that sulphuret of calcium had probably been formed, and that the sulphuretted hydrogen, which had led to the death of the deceased, had been evolved from this by the oil of vitriol. It is more probable, however, that the gas was evolved by the decomposition of the liquid hydrosulphate of ammonia, which always abounds in such localities.

The following case, which has a close relation to this subject, occurred in London in 1831:—Twenty-two boys, living at a boarding-school at Clapham, were seized in the course of three or four hours with alarming symptoms of violent irritation in the stomach and bowels, spasms of the muscles of the arm, and excessive prostration of strength. One child, which had been similarly attacked three days before, died in twenty-five hours; and one among the last attacked died in twenty-three hours.

Both of the bodies were examined after death: in the first the mucous glands of the intestines were found enlarged, and, as it were tuberculated. In the second, the mucous coat of the small intestines was found ulcerated, and *that* of the colon softened. At first it was suspected that the boys had been poisoned, but an analysis of the food did not lead to the discovery of any noxious substance. The only circumstance which was considered sufficient to explain the accident was, that *two days* before the first child was seized, a foul cesspool had been opened and the materials diffused over a garden adjoining the children's play ground. This was the source of the noxious effluvia according to the opinion expressed by six medical practitioners. (Christison on Poisons, 810.)

Analysis.—The recognition of these gases and vapours is a simple operation. The odour which they possess is sufficient to determine their presence, even when they are diluted with a large quantity of atmospheric air. The *sulphuretted hydrogen gas* is at once identified by its action on paper previously dipped in a solution of a salt of lead: if present, even in very small proportion, the moistened paper speedily acquires a brownish-black stain from sulphuret of lead. It must not be supposed that sulphuretted hydrogen, when it has proved fatal in a *diluted* form, can be detected in the lungs, stomach, or blood of a dead body. When the body is recently removed from a drain or sewer, the gas may be found pervading the whole of the tissues: but in other cases it will be as useless to look for it, as for carbonic acid in poisoning by this gas. Noxious gases are not long retained by the tissues; a short exposure will suffice to remove all traces of them. The examination of the locality may throw a light upon the cause. The proportion of the gas found in an apartment can, however, rarely be a criterion of the quantity which has destroyed life. A person going into a room where the deceased bodies are lying, may notice only a disagreeable or a stifling smell, but he may be able to breathe for a longer or shorter period with the door or window open. It is not the respiration of a few minutes, but the breathing of the diluted noxious atmosphere for many hours, that really destroys life. The best method of detecting sulphuretted hydrogen when present in a dead body (not putrefied) is to place a piece of polished silver, or of glazed card, in an incision made into the muscles or soft organs. It will be tarnished, or acquire a brown colour, if the gas be present.

Sulphuretted hydrogen may be proved to exist by the lead test in the vapour of *hydrosulphate of ammonia* when mixed with air; and the presence of ammonia is indicated in the compound by the volatile alkaline reaction on test-paper; also by holding, in a vessel containing the vapour recently collected, a rod dipped in strong muriatic acid: the production of dense white fumes announces the formation of muriate of ammonia. It is a fact which cannot be too universally known that a candle will readily burn in a mixture of either of these gases with air, which, if respired, would suffice to destroy life. (Ann. d'Hyg. 1829, vol. 2. p. 69.) It is also worthy of remark that the air of a cess-pool may be often respired with safety until the workmen commence removing the soil, when a large quantity of mephitic vapour may suddenly escape, which will lead to the immediate suffocation of all present. Several persons have been killed by trusting to the burning of a candle, in ignorance of this fact. In descending in order to render assistance to persons who are lifeless, the person should on these occasions, whether sulphuretted hydrogen or carbonic acid be the cause, make a moderate inspiration of pure air and hold his breath while in the noxious mixture. In an accident which occurred in Whitechapel, in August 1857, three men died speedily from breathing the vapour of an old sewer, and two others nearly lost their lives in attempting to assist them. The best plan for getting rid of the gas is by a free exposure of the locality, or by exciting active combustion in it. According to Parent-Duchâtelet, men can work in an atmosphere containing from two to three per cent. of sulphuretted hydrogen. The air of one of the principal sewers of Paris gave the following results, on analysis, in 100 parts:—oxygen, 13·79; nitrogen, 81·21; carbonic acid, 2·01; sulphuretted hydrogen, 2·99.

EXHALATIONS FROM THE DEAD.

It may be proper in this place to make a few remarks on the alleged danger of the exhalations given off by dead bodies in a state of putrescence. Formerly there existed a groundless fear relative to the examination of a putrefied dead body: and during the last century, on several important occasions, medical witnesses refused to examine the bodies of deceased persons who were presumed to have been murdered, alleging that it was an occupation which might be attended with serious consequences to themselves. Orfila has collected many accounts of the fatal effects which are recorded to have followed the removal of the dead some time after interment. (Traité des Exhumations, vol. 1. p. 2, *et seq.*) He allows, however, that the details of most of these cases are exaggerated, and attributes to other causes the effects which followed. Indeed, the observations of Thouret and Fourcroy prove that these dangers are restricted within a narrow compass, and that in general, with common precautions, the dead may be disinterred and transported from one locality to another, without any risk to those engaged in carrying on the exhumations. About the latter part of the last century from fifteen to twenty thousand bodies, in almost every stage of putrefaction, were removed from the Cimetière des Innocens in Paris; and the accidents that occurred during the operations, which lasted ten months, were comparatively speaking few. The workmen acknowledged to Fourcroy that it was only in removing the recently interred corpses, and those which were not far advanced in decomposition, that they incurred any danger. In these cases the abdomen appeared to be much distended with gaseous matter; if ruptured, the rupture commonly took place about the navel, and there issued a bloody fetid liquid, accompanied by the evolution of a mephitic vapour —probably a mixture of carbonic acid and sulphuretted hydrogen. Those who respired this vapour at the moment of its extrication, fell instantly into a state of asphyxia and died; while others who were at a distance, and who consequently respired it in a diluted state, were affected with nausea, giddiness, or fainting. lasting some hours, and followed by weakness and trembling of the limbs. Chloride of lime was formerly employed for decomposing these vapours; but a strong solution of nitrate of lead, or chloride of zinc, may be substituted for it. Peat-charcoal, or the charcoal of oak bark (the refuse of tan-pits), has also a powerful deodorizing action. (See on this subject Henke's Zeitschrift, 1840, vol. 2. p. 446; Ann. d'Hyg. 1832, p. 216; 1840, p. 131; 1840, pp. 28, 32.)

In addition to these, there are other gases and vapours of a poisonous nature which are for the most part artificial products. It is seldom that individuals are exposed to respire them in such quantity as to cause serious symptoms or to endanger life.

LIGHTNING. COLD. STARVATION.

CHAPTER 65.

LIGHTNING — EFFECTS OF THE ELECTRIC FLUID — CAUSE OF DEATH — POST-MORTEM APPEARANCES — CASES — LEGAL RELATIONS. COLD — AN OCCASIONAL CAUSE OF DEATH — SYMPTOMS — CIRCUMSTANCES WHICH ACCELERATE DEATH — POST-MORTEM APPEARANCES — CASE OF MURDER BY COLD. STARVATION — A RARE CAUSE OF DEATH — SYMPTOMS — APPEARANCES AFTER DEATH — SUMMARY OF MEDICAL EVIDENCE — LEGAL RELATIONS.

LIGHTNING.

Effects of the electric fluid.—Death by lightning is sufficiently common to require that a medical jurist should be prepared to understand the phenomena which accompany it: but there is a more important reason why we should devote some attention to this subject: that is, that the appearances left by the electric fluid on the human body sometimes closely resemble those produced by extreme mechanical violence. Thus, a person may be found dead in an open field, or on the highway; his body may present the marks of contusion, laceration, or fracture; and to one unacquainted with the fact that such violence occasionally results from the passage of this subtle agent through the animal system, it might appear that the deceased had been maltreated, and probably murdered. The greater number of deaths from the electric fluid take place during the spring and summer. According to one annual report, there were 24 deaths from lightning registered during the year, occurring in the following seasons:—summer, 11; spring, 10; autumn, 2; winter, 1. Out of 103 deaths from lightning in five years (1852-6), there were 38 in July and 22 in the month of August.

Cause of death.—The electric fluid appears to act fatally by producing a violent shock to the brain and nervous system. In general there is no sense of pain; the individual falls at once into a state of unconsciousness. In a case which did not prove fatal, the person, who was seen soon after the accident, was found labouring under the following symptoms. Insensibility; deep, slow, and interrupted respiration; entire relaxation of the muscular system; the pulse soft and slow; the pupils dilated, but sensible to light. (Med. Gaz. vol. 14. p. 654.) It will be seen that these are the usual symptoms of concussion of the brain. The effect of a slight shock is that of producing stunning; and, when individuals who have been severely struck recover, they suffer from ringing in the ears, paralysis, and other symptoms of nervous disorder. Insanity has even been known to follow a stroke of lightning. (Conolly's Report of Hanwell, 1839.) In one case the person remained delirious for three days, and when he recovered he had completely lost his memory. (Lancet, Aug. 3, 1839, p. 582.) A boy, æt. 4, received a severe shock on the 11th May, was seized with tetanus on the 13th, and died in four hours. (Med. Times and Gaz. May 26, 1855.) In another instance, an old man who took shelter under a tree felt as if a vivid flash had struck him in the face. He did not fall, but he was almost blind. He suffered for some days from frontal headache, and amaurosis supervened. (Med. Times and Gaz. July 24, 1858.)

It may be observed of the effects of lightning generally, that death is either immediate, or the individual recovers. A person may, however, linger, and die from the effects of severe lacerations or burns indirectly produced. A case occurred in this city, in July 1838, where death was thus caused indirectly by the effects of electricity. The following case of recovery illustrates the action of the electric fluid:—Three persons were struck by lightning at the same time. In one, a healthy man, æt. 26, the symptoms were severe. An hour and a half after the stroke he lay completely unconscious, as if in a fit of apoplexy;—his pulse was below 60, full and hard, his respiration snoring, his pupils dilated and insensible. There were frequent twitchings of the arms and hands: the thumbs were fixed and immovable, and the jaws firmly clenched. Severe spasms then came on, so that four men could scarcely hold the patient in his bed; and his body was drawn to the left side. When these symptoms had abated, he was copiously bled, cold was applied to the head, and a blister to the nape of the neck, and mustard poultices to the legs. Stimulating injections and opium were also administered: in the course of twenty-four hours consciousness slowly returned, and the man soon completely recovered. The only external injury discoverable was a red streak as broad as a finger, which extended from the left temple over the neck and chest: this disappeared completely in a few days. (Brit. and For. Med. Rev. Oct. 1842.)

Appearances after death.—The suddenness of death is such that the body sometimes preserves the attitude in which it was struck. (Med. Times and Gaz. Feb. 18, 1860, p. 167.) Generally speaking, the body, externally, presents marks of contusion and laceration about the spot where the electric current has entered or passed out:—sometimes a severe lacerated wound has existed:—on other occasions there has been no wound or laceration, but an extensive ecchymosis, which, according to Meyer, is most commonly found on the skin of the back. In one instance, which occurred in London in May 1839, there were no marks of external violence, and several similar cases are quoted from American journals in the Medical Times (May 3, 1845, p. 82). The clothes are in almost all cases rent and torn, and partially singed, giving rise to a peculiar odour,—sometimes even rolled up in shreds and carried to a distance. They are occasionally found partially burnt; but this is not a frequent occurrence. Metallic substances about the person present traces of fusion, and articles of steel have been observed to acquire magnetic polarity. Dr. West has informed me, that in a case to which he was called, in which a boy, æt. 18, had been instantly struck dead by lightning, he observed that a knife in the pocket of the deceased had acquired strong magnetic polarity. The case further shows that which has frequently been noticed, namely, that while much violence had been done to the dress, the parts of the body covered by it had escaped injury. The deceased wore at the time of the accident a pair of strong leather boots. These were torn to shreds, probably owing to the presence of iron nails in the soles, but the feet of the deceased presented no mark of injury! An accident by lightning occurred in the presence of a friend of mine, by which a healthy man was instantaneously killed. A cap which the man wore had a hole through it. His hair was singed, his shoes were burst open, and his trousers torn. The woodwork of the building down which the electric fluid passed was merely split, and there was no mark of burning. I have examined, in several instances, the wood of trees which have been struck by the electric fluid. In each case it has presented only the appearance of rending by mechanical force.

Wounds are sometimes met with on the body. These have commonly been lacerated punctures, like stabs produced by a blunt dagger. In the case of a person who was struck, but not killed, a deep wound was produced in one thigh, almost laying bare the femoral artery. This person was struck, as many others have been, while in the act of opening an umbrella during a storm. Fractures of the bones have not been commonly observed : in a case mentioned by Pouillet, the skull was severely fractured, and the bones depressed. (Traité de Physique, Elect. Atmosph.) The *burns* occasionally found on the bodies of those who have been struck by lightning have been hitherto ascribed to the ignition of the clothes. It appears, however, from the subjoined cases, that burns even of a severe kind may be the result of a direct agency of the electric fluid itself upon the body. Dr. Geoghegan met with the case of a girl who had been struck by lightning : there was burning of the thigh and buttocks to the first and second degrees, but the clothes did not show any signs of combustion. I am indebted to Mr. Fisher, of Dudley, for a more detailed account of a case illustrating the same point. On the 16th of July 1852, a man, æt. 23, while engaged in milking a cow in a wooden shed, during a severe thunder-storm, suddenly observed a vivid flash of lightning, which killed the cow instantly, and inflicted serious injuries upon him. Mr. Fisher saw him sixteen hours after the accident, and found a severe burn on his person, extending from the right hip to the shoulder, and covering a large portion of the front and side of the body. His mind was then wandering, and there were symptoms of inflammatory fever. The man was confined to his bed for seventeen days, at the end of which time the injuries had not perfectly healed. On examining his dress, the right sleeve of his shirt was found burnt to shreds, but there was no material burning of any other part of the dress. The case is singular, inasmuch as it shows that the dress may be burnt without the surface of the body being simultaneously injured ; and further, that a burn may be produced on the body, although the clothes covering the part may have escaped combustion. Mr. Fleming has described the cases of eight persons who were struck by lightning : and on the bodies of some of these, there were marks of severe burns. The dresses were, in parts, much singed. These cases show, in a remarkable manner, the intense heat evolved in the instantaneous passage of the electric fluid through the clothes and body. The persons struck were benumbed or paralyzed in various degrees; but all ultimately recovered. The burns were so severe, that some months elapsed before they were entirely healed. (Glasgow Med. Journal, Oct. 1859, p. 257.)

The following complete account of the external and internal appearances found in the body of a healthy middle-aged labourer, who was killed by a stroke of lightning, has been published by Dr. Schaffer. The man was working in the fields with several other labourers, just after a thunder-storm had passed over and had apparently subsided. He was endeavouring to kindle a light with a flint and steel, when the lightning struck him. For a moment after the shock he stood still, and then fell heavily to the ground. The electric fluid entered at the upper part of his forehead, perforating and tearing his hat at that part: it seemed then to have become divided into two currents, which passed down the sides of the trunk, along the lower limbs, and out at the feet. On the upper part of the forehead was found a soft swelling, of a dark blue colour, and about the size of the palm of a hand: the hair which covered it was uninjured. From this spot two dark red streaks proceeded in different directions. One of these passed to the left, running over the temple, in front of the left ear, down the neck to the surface of the chest, over which it passed between the left nipple and the arm-pit, and so made its way down the trunk to the left inguinal region, where it formed a large, irregular, scorched-looking (brandige) patch on the skin. From this point the dark red streak again continued its downward course, passing over the great trochanter, then along the outer surface of the left leg to the back of the foot, where it terminated in several small dark blue spots. The other streak, which proceeded from the ecchymosed swelling on the forehead, passed directly to the right ear, which was considerably swollen and of a dark blue colour:—from the ear it ran downwards and backwards along the neck, crossed the right border of the scapula, and eventually reached the right groin, where a scorched patch of skin similar to that in the left groin was found. From this part the discoloured streak continued down the outer side of the right leg to its termination on the back of the foot, just as on the left side. It is remarkable, that although the hair on the forehead, as well as that which occurred in any part of the track taken by the electric current down to the groin, was not burnt, yet at the groin itself, and at every part hence to the foot over which the electric stream had passed, the hairs were completely burnt. The cause of the skin and hair in the groins being burnt, is probably to be referred to the buckles of a belt which the man wore round his abdomen at the time of the accident: the belt was completely destroyed. Nothing further worthy of notice was observed on the exterior of the body, with the exception of the face being very red. The swelling of the head was found to be due to the presence of a large quantity of extravasated blood. The bone beneath was not injured. Blood was effused in other parts of the scalp corresponding to the swollen discoloured patches outside; about four ounces had been effused. The vessels of the cerebral membranes were much congested, and the brain itself contained a large quantity of blood, especially the choroid plexuses. A large quantity of reddish mucus was found in the larynx, trachea, and air-tubes. The lungs were loaded with dark blood: there was a great deficiency of blood in the cavities of the heart and in the large vessels. The blood-vessels of the stomach and intestines were more than usually congested. The right lobe of the liver was of a dark-red colour, and loaded with blood, especially the part which corresponded to the burnt patch of skin at the lower part of the abdomen. The spleen also was large, and filled with blood. Much blood was found accumulated in the substance of the muscles of the abdomen, at those parts which lay beneath the burnt surfaces outside. (Oesterreich. Med. Wochenschrift, 6 Juni 1846.)

In another case, that of an old man killed by lightning, the external surface of the body presented slight marks of violence, except the left ear, which was severely lacerated. On opening the head, the left hemisphere of the brain was found entirely disorganized, forming a homogeneous mass, almost liquid, of a greyish colour, and without a vestige of normal structure, except a small portion of the corpus striatum, which had retained its natural appearance and situation. The left lung was partly injured. The skin of the abdomen was marked by black longitudinal superficial lines. On the skin of the left ankle there was an ecchymosed spot, and at the point of the foot a deep wound. The hat and shoes of the deceased had been destroyed, but the rest of his clothes were uninjured. (Heller's Journal, Feb. 1845, 245.) The following appearances were found in the body of *Professor Richman*, who was killed at St. Petersburg, in 1753, while engaged in some experiments on atmospheric electricity. On the left side of the forehead, where the deceased had been struck by the electric current, there was a round ecchymosed spot. There were eight other patches of ecchymosis of variable size, extending from the neck to the hip, principally on the left side. Some of these, situated on the trunk, resembled the marks produced by gunpowder, when discharged in contact with the skin. The left shoe was torn open at the buckle without being singed or burnt; but the skin around was slightly ecchymosed. Internally a quantity of blood was found extravasated in the trachea, the lungs, and the layers of the omentum. The omentum presented the appearance of having been violently contused.

(Marbach's Encyklopädie, Blitz.) For a further account of the effects of the electric fluid on the human subject, see Henke, Zeitschrift der S. A. 1844, vol. 1. p. 933.

The blood is said not to become coagulated in the bodies of those who have been killed by lightning, while the muscles of such subjects are described as being constantly in a state of perfect relaxation, and never displaying any appearance of cadaveric rigidity. These statements are not supported by observation. Experiments carefully performed have shown that blood through which electric discharges have been transmitted, will coagulate as quickly as that which has not been thus treated: and further, Sir C. Scudamore discovered that, on examining the bodies of animals killed by the discharge of a powerful galvanic battery, the blood in the veins was always in a solid state. There is obviously, therefore, nothing in the action of the electric fluid to retard or prevent the coagulation of the blood. With respect to the alleged absence of cadaveric rigidity, there are many circumstances which may accelerate or retard the accession of this state in dead muscle,— it may take place and disappear quickly, and the body may not be seen at that particular time by the medical examiner. Sir B. Brodie remarked that the body of an animal killed by electricity became, as usual, rigid after death. In an accident which occurred in France, in August 1846, a group of labourers was struck by the electric fluid: — four were killed on the spot, and five or six severely wounded. It was remarked that the person whose body bore the most extensive marks of injury had worn a goat-skin. There were severe lacerations about this body, and in three hours after death it became perfectly rigid. In most of those who were struck, the skin was reddened, but the clothes bore no marks of burning. (Med. Gaz. vol. 38. p. 351.) In a case communicated to the Medical Gazette by Dr. F. J. Brown, rigidity was strongly marked in the limbs about twenty-eight hours after death. (Vol. 47. p. 844.) In May 1854, during a storm, a man was struck by the electric fluid. He made a short exclamation, and immediately expired. The fluid was found to have produced a burnt mark at the top of the head: it had passed down the right side of the neck and body, thence to the left thigh and leg, and had made its exit at the fore part of the foot, in which situation there was a livid mark. The deceased's shirt had taken fire, and was partially burnt. There were marks of burning on the front of the abdomen, and blood flowed from the left ear. The left leg of deceased's trowsers, as well as the shoe and stocking, was rent in various places. The countenance was remarkably placid. It was observed in this case that the body became rigid after death. Putrefaction is said to be hastened in these subjects; but putrefaction is modified by many varying circumstances, and death by lightning usually takes place during summer, when the process is most readily developed. It does not appear that the process takes place more speedily than in sudden or violent death from any other cause. Facts are now sufficiently numerous to enable us to say that the old opinion of the absence of rigidity, and the acceleration of putrefaction in the bodies of persons killed by lightning, was unfounded. Dr. Bagot, of Ballingarry, has informed me that in a case which he examined in the summer of 1855, the body of a man, æt. 28, who had been killed by lightning, was as rigid twenty-eight hours after death as if death had taken place from any other cause. This man was struck on the back of the neck, the spot being indicated by a black mark. Putrefaction was not accelerated. In fifty-one hours after death, there was comparatively little appearance of it. Dr. Erpenbeck was called to see a man who had been suddenly struck dead during a storm, and he found on attempting to draw blood from the arm, that small bubbles of air issued with the blood. (Casper, Vierteljahrschrift, Jan. 1861, p. 167.) But few detailed reports have been published of the appearances met with in the body, in cases of death from lightning. The body of a person who has died under these circumstances is seldom examined for a coroner's inquest, the cause of death being sufficiently obvious.

Legal relations.—Rare as the combination of circumstances must be, in which a medico-legal question can arise in reference to the action of the electric fluid on the body, a case was tried in France, in October 1845, in which medical evidence respecting the characters of wounds caused by electricity was of considerable importance. In August of that year some buildings were destroyed at Malaunay, near Rouen, as it was alleged on the one side, by a thunder storm, on the other by a whirlwind; and as the parties were insured against lightning, they brought an action for recovering the amount insured. The evidence in favour of the accident having been due to electricity consisted,—1st, in the alleged carbonized appearance of the leaves of some trees and shrubs growing near; and 2nd, in the characters of the wounds on the bodies of several persons who were injured at the time of the occurrence. M. Lesauvage stated at the trial that there was an appearance of dark stains scattered over the bodies, and those who survived suffered from torpor, pains in the limbs, and partial paralysis of motion. He observed also that putrefaction took place very speedily in the bodies of those who were killed. In one instance the muscles were torn and lacerated, and some small arteries divided. This witness attributed most of the wounds to a current (discharge ?) of electricity. M. Funel deposed that in some of the dead bodies which he examined, the face and neck were bloated and discoloured, as if death had taken place from asphyxia. It does not appear, however, that there were any circumstances decisively proving that the buildings had been destroyed by lightning. M. Pouillet has given an accurate description of the storm; he believed that, although, as deposed to by some of the witnesses at the trial, it may have been attended with thunder and lightning, the buildings with the surrounding trees were overthrown by the mere force of the wind, and not by the electric fluid. The description given bears out this view, but at the same time it is, I believe, a rare circumstance that trees when struck, unless old or dry and withered, bear any marks of combustion about the leaves or trunk. (See Comptes Rendus, Sept. 1845; also Med. Gaz. vol. 36. p. 1133.) The scientific evidence was of the most conflicting kind. The Royal Court of Rouen decided that the disaster was occasioned by the atmosphere; and without entering into the various theories of storms, condemned the Insurance Companies to pay the amount claimed. (Law Times, March 14, 1846, p. 490.)

COLD.

An occasional cause of death.—The protracted exposure of the human body to a low temperature may be a cause of death; and although in this country cases but rarely occur in which cold alone operates fatally, it is not unusual, during a severe winter, to hear of persons being found dead in exposed situations, and in a state of misery and destitution. On these occasions we may reasonably suspect that the want of proper food and nourishment has accelerated death. It is, however, convenient to make a distinction between the effects of cold and of inanition on the system, as the symptoms preceding death, and the rapidity with which that event takes place, are different in the two cases.

Symptoms.—A moderate degree of cold is well known to have an invigorating effect upon the body; but if the cold be severe, and the exposure to it long continued, while the calorific function is not maintained by warmth of clothing or exercise, the skin becomes pale, and the muscles become gradually stiff and contract with difficulty, especially those of the face and extremities. Sensibility speedily disappears, a state of torpor ensues, followed by profound sleep, from which the person cannot be readily roused: in this state of lethargy the vital functions gradually cease, and the individual finally perishes. Such are the general effects of intense cold upon the body. The effect of cold upon the nervous system is seen in the numbness, torpor, and somnolency which have been described as consequences of a long exposure to a low temperature. Giddiness, dimness of sight, tetanus, and paralysis, in some cases precede the fatal insensibility which involuntarily steals on the individual. It has been found that temperature materially affects the amount of oxygen taken by the blood. At a low temperature it takes less oxygen; hence the blood becomes less oxygenated, and this state of the blood affects the nervous system. (Bernard, p. 114.) It was observed during the retreat of the French from before Moscow that those who were most severely affected by cold often reeled about as if in a state of intoxication. They also complained of giddiness and indistinctness of vision, and sank under a feeling of lassitude into a state of lethargic stupor, from which it was found impossible to rouse them. Sometimes the nervous system was at once affected—tetanic convulsions, followed by rigidity of the whole of the voluntary muscles, seized the individual, and he rapidly fell a victim. Symptoms indicative of a disturbance of the functions of the brain and nervous system have also been experienced by Arctic travellers during their residence within the Polar circle.

Circumstances which accelerate death.—There are certain conditions which may accelerate death from cold. In all cases in which there is exhaustion of the nervous system, as in the aged and infirm,—in those who are worn out by disease or fatigue,—or, lastly, in those who are addicted to the use of intoxicating liquors, the fatal effects of cold are more rapidly manifested than in others who are healthy and temperate. It has been uniformly remarked that, whenever the nervous energy is impaired either by intoxication or exhaustion from fatigue, the subject falls an easy victim to cold. The exposure of persons in a state of intoxication, during a severe winter, may therefore suffice to destroy life, although the cold might not be so intense as to affect others who were temperate. Casualties of this nature sometimes occur during the winter season in this metropolis; and a knowledge of the influence of intoxication in accelerating death, under such circumstances, may occasionally serve to remove a doubt in the mind of a practitioner respecting the real cause. Infants, especially when newly born, easily perish from exposure to cold. Cold, when accompanied by rain and sleet, appears to have a more powerfully depressing influence than when the air is dry,—probably from the effects of evaporation. The following case by Dr. Currie shows the fatal effects of cold winds accompanied by humidity. "Of several individuals who clung to a wreck, two sat on the only part that was not submerged; of the others, all were constantly immersed in the sea, and most of them up to the shoulders. Three only perished, two of whom were generally out of the sea, but frequently overwhelmed by the surge, and at other times exposed to heavy showers of sleet and snow, and to a high and piercing wind. Of these two, one died after four hours' exposure; the second died three hours later, although a strong healthy adult, and inured to cold and hardship. The third that perished was a weakly man. The remaining eleven, who had been more or less completely submerged, were taken from the wreck the next day, after twenty-three hours' exposure, and they recovered. The person among the whole who seemed to have suffered least, was a negro: of the other survivors, several were by no means strong men, and most of them had been inured to the warm climate of Carolina."

Appearances after death.—Opportunities rarely occur of examining bodies when death results purely from exposure to cold. The surface is commonly pallid, and the viscera of the chest and abdomen as well as the brain are congested with blood. Dr. Kellie, of Leith, found in two cases which he examined, a redness of the small intestines from the congestion of the capillary vessels, and a great effusion into the ventricles of the brain. A sufficient number of cases have not yet been inspected to enable us to determine how far these two last-mentioned appearances are to be regarded as consequences of death from cold; but all observers have found a general congestion of the vascular system internally. In consequence of the great congestion uniformly met with in the vessels and sinuses of the brain, some pathologists have regarded death from cold as resulting from an attack of apoplexy; but the symptoms which precede death do not bear out this view. Effusions of blood have not been observed, and a mere fulness of the cerebral vessels after death is not in itself sufficient to justify this opinion. It will be observed, that on the whole these appearances are remarkably similar to those which are found in death from severe burns and scalds. Thus then the medical jurist will perceive, that in order to come to a decision whether, on the discovery of a dead body, death has taken place from cold or not, is a task of great difficulty. The season of the year,—the place and circumstances under which the deceased is found,—together with the absence of all other possible causes of death (such as from violent injuries or internal disease), form the only basis for a medical opinion. Death from cold is not to be determined except by negative or presumptive evidence, for there is no organic change, either externally or internally, sufficiently characteristic of it to enable us to decide positively on the subject.

Case of murder by cold.—The following case involved the question of the fatal effects of cold upon the body. A man and his wife, residing at Lyons, were tried for the murder of their daughter, a girl aged eleven, under the following circumstances:—On the 28th of December, at a time when there was a severe degree of cold, the female prisoner compelled the deceased to get out of her bed, and place herself in a vessel of ice-cold water. The child cried and endeavoured to escape from the bath; but she was by violence compelled to remain in the water. The deceased complained of exhaustion and dimness of sight: the prisoner then threw a pail of iced water upon her head, soon after which the child expired. Death was properly ascribed to the effects of this maltreatment, and the parties were convicted. (Ann. d'Hyg. 1831, 207.) See Med. Times and Gazette, July 21, 1860, p. 61. This case presents a refinement of cruelty which is rarely met with in the annals of crime. Such a case could only be proved by circumstances; for there would be no appearances in the body, internally or externally, to indicate the mode of death. We learn by this, that the death of infants or children may be caused by the external application of cold liquids, coupled with exposure. It would also appear from this case, that the brain and nervous system are sympathetically affected through the skin, and not through the introduction of cold air into the lungs. Indeed, it is well known, from the experience of Arctic travellers, that air of a temperature considerably below zero may be respired without risk, provided the skin be kept warm.

In *Reg.* v. *Lovell* (Gloucester Lent Ass. 1853), a woman was convicted of the manslaughter of a child aged four years. The child it seems was in a diseased condition, and the prisoner, during the month of January, placed her under the pump in the yard, and turned the cold water upon her. The medical witness did not consider that this accelerated death, but the jury returned a verdict of guilty; and on passing sentence the late Mr. Justice Talfourd observed, that the verdict was based on common sense and reason, although against the opinion of the medical witness!

STARVATION.

A rare cause of death.—Death from the mere privation of food is a rare event, although, if we were to form an opinion from the verdicts of coroners' juries, its occurrence would not appear to be uncommon in this and other large cities. In the Registration Returns for 1838-9, it is stated that 130 persons died from starvation. Such cases must, however, be received with some distrust, as care is rarely taken to ascertain precisely how far bodily disease may have been concerned in causing death. Still, it cannot be denied that starvation should be classed among the forms of violent death, being sometimes the result of criminal neglect or inattention in the treatment of children or of infirm and decrepid persons, and thus constituting homicide: or at other times, although rarely, arising from an obstinate determination to commit suicide in those from whom all other means of self-destruction are cut off.

Symptoms.—The symptoms which attend on protracted abstinence are thus described by Rostan and Orfila:—In the first instance, pain is felt in the epigastrium, which is relieved by pressure. The countenance becomes pale and livid or cadaverous,—the eyes are wild and glistening,—the breath hot,—the mouth dry and parched,—the saliva thick and sparingly secreted. An intolerable thirst supervenes, which, in all cases of attempted suicide by starvation, or privation of food from accident, has formed the most prominent symptom. The body becomes emaciated, the eyes and cheeks sink, and the prominences of the bones are perceptible: the feeling of pain may be so intense as to give rise to delirium. There is the most complete prostration of strength, which renders the person incapable of the least exertion. After a longer or shorter period the body exhales a fetid odour, the mucous membrane of the outlets becomes sometimes red and inflamed, and death may be preceded by a fit of delirium, or by convulsions. (Cours Elémentaire d'Hygiène, vol. 1. p. 283, *et seq.*; and Orfila, Médecine Légale, vol. 1. p. 415.) The symptoms of violent excitement described by these writers have been chiefly witnessed in the cases of shipwrecked mariners, and they may have been partly due to the peculiar effects of a tropical climate (Orfila, Méd. Lég. vol. 1. p. 415), or to the drinking of wine, spirits, salt-water, or even their own urine. (Dr. Martyn, in Med. Times and Gazette, March 30, 1861, p. 344.) Referring to cases which occurred during the Irish famine of 1847, Dr. Donovan states that the persons who suffered, described the pain of hunger as at first very acute, but said that after twenty-four hours had been passed without food, the pain subsided, and was succeeded by a feeling of weakness and sinking, experienced principally in the region of the stomach, accompanied with insatiable thirst, a strong desire for cold water, and a distressing feeling of coldness over the entire surface of the body. In a short time the face and limbs became frightfully emaciated; the eyes acquired a most peculiar stare; the skin exhaled a peculiar and offensive smell, and was covered with a brownish, filthy-looking coating, almost as indelible as varnish. This, he was at first inclined to regard as incrusted filth, but further experience convinced him that it was a secretion poured out from the exhalants on the surface of the body. The sufferer tottered in walking, like a drunken man: his voice became weak, like that of a person in cholera; he whined like a child, and burst into tears on the slightest occasion. In respect to the mental faculties, their prostration kept pace with the general wreck of bodily power; in many there was a state of imbecility; in some, almost complete idiotism; but in no instance was there delirium or mania, which has been described as a symptom of protracted abstinence among shipwrecked mariners. (Dub. Med. Press, February 1848, p. 67.)

In addition to the symptoms above described, Orfila describes the existence of severe pain in the region of the stomach, a suppression of the fæces, or, if discharged, they are in small quantity, dry, and dark-coloured; the urine is scanty, high-coloured, and turbid; the intellect is dull. The person may be exhausted, and remain without motion in one position, or be seized with a furious delirium, which may drive him to acts of violence. In the last stage the body is reduced to an extreme state of emaciation, and before death it evolves a foul odour, like that of incipient putrefaction. The excretions have also a putrescent odour. The surface of the skin may be covered with petechiæ, and the person finally dies, in some cases slightly convulsed. (Op. cit. p. 415.) M. Chassat found, in his experiments on animals, that in some instances the animal died after having had successive attacks of convulsions. (Beck's Med. Jur. vol. 2. p. 80.) In a case which fell under the notice of Dr. Sloan, a healthy man, æt. sixty-five, was by an accident shut up in a coal mine for twenty-three days without food. When found he was conscious. He recognized and named his deliverers. He was so weak that he could scarcely raise his hand to his mouth. He was so much emaciated as to excite the surprise of his fellow-workmen by the extreme lightness of his body. Under careful treatment he so far recovered as to give an account of his feelings. For the first two days hunger was his most urgent symptom. This passed off, and he then began to suffer from severe thirst, which he allayed by drinking some foul water. After ten days he became so weak that he was unable to move from the spot where he had lain down. He slept but little, and never soundly—never entirely losing the consciousness of his situation. His bowels acted only once, but he passed urine freely. The matter brought from his bowels by injections was black, like meconium, and very fœtid. He died on the third day after his removal, in spite of every effort to save him, and on the day of his death he was in the following state:—His features were sharp and pale, his eyes sunk, the parietes of the abdomen seemed to touch the backbone, which could be distinctly felt through them; his body presented more emaciation than Dr. Sloan had ever seen produced by disease; he had altogether a dried appearance, very much like that of natural mummies found in catacombs; his pulse was gone; his voice was in a whisper, like the *vox cholerica;* there was uneasiness, increased by pressure in the region of the stomach; his intellect was sound, and remained so until death. (Med. Gaz. vol. 17. p. 265.) This case confirms the observation of Dr. Donovan, that delirium is not a necessary attendant on protracted abstinence, and it proves incontestably that a person may die from the effects of abstinence or starvation, in spite of the best directed efforts for recovery. Mr. Thornhill reports, in the same journal, the cases of eight men and a boy who were shut up in a coal-mine for eight days without food (Med. Gaz. vol. 17, p 390); but the symptoms here noted were rather those of hunger than of long abstinence. They all suffered from excessive thirst. They were all troubled with ocular illusions, showing cerebral excitement. The occurrence of ocular spectra, and other symptoms indicative of a depressed state of the nervous system, has also been noticed by Casper. (Handbuch der Ger. Med. 1857, vol. 1. p. 374.) According to Dr. Martyn the emaciation in starvation is characteristic; it is a withering or shrivelling up of the skin, which has lost its elasticity, giving to youth the aspect of age. Death, when not hastened by disease, is slow and imperceptible, or it is precipitated by syncope from sudden effort, or by exposure to severe cold. Delirium is not, according to him, a symptom of starvation. (Med. Times and Gaz. March 30, 1861, p. 344.) The period which it requires for an individual to perish from hunger is subject to variation. It will depend materially upon the fact whether a person has it in his power or not to take at intervals a portion of liquid to relieve the overpowering thirst which is commonly experienced. The smallest portion of liquid thus taken occasionally is found to be capable of prolonging life. It is probable that in a healthy subject, under perfect abstinence, death would not commonly take place in a shorter period than a week or ten days. This opinion appears to derive support from the results of those cases in which there has been abstinence owing to disease about the organs of deglutition. Age, sex, state of health, and the effects of exposure to cold, may accelerate or retard the fatal termination of the case.

Appearances after death.—There are but few details of the appearances presented by the bodies of those who have died of starvation, and the cases themselves are too rare to enable us to decide with certainty upon the accuracy of the reports which have hitherto appeared on the subject. The body is shrunk and emaciated, and remarkable for its lightness. The skin is dry, shrivelled and free from fat. The muscles are soft, deprived of fat, and much reduced in volume. The stomach and intestines are usually found collapsed, contracted and empty,—the mucous membrane being thinned and sometimes ulcerated. The liver, lungs, heart, kidneys, and the great vessels connected with these organs are collapsed and destitute of blood; the heart and kidneys free from any surrounding fat: the gall-bladder distended with bile: the omentum shrunk and destitute of fat. In Dr. Sloan's case (*supra*) the body was observed to be extremely emaciated: the intestines were collapsed, the stomach was distended with air, and slightly reddened at its greater extremity. The omentum had almost disappeared: it was entirely destitute of fat. The liver was small, and the gall-bladder distended with bile. The other viscera were in their normal state. (Med. Gaz. vol. 17. p. 389.) Mr. Tomkins, of Yeovil, inspected the body of a man who died from starvation in February 1838. The face was much shrunk and emaciated; the eyes were open, and presented a fiery red appearance, as intense as in a case of acute ophthalmia during life. This red appearance has been met with by Dr. Donovan in death from exposure to cold. (Dublin Med. Press, Feb. 2, 1848, p. 66.) The skin was tough, and there was scarcely any cellular membrane to be seen. The tongue, lips, and throat were dry and rough. A peculiar odour exhaled from the body. The lungs were shrunk and contracted; the pleura was slightly inflamed. The stomach and intestines were empty, but quite healthy; the gall-bladder was nearly full of bile, and the surrounding parts were much tinged by this liquid. The uninary bladder was empty and contracted. (Lancet, March 1838.) In some cases inspected during the Irish famine, Dr. Donovan states that the appearances which he witnessed were extreme emaciation, total absorption of the fatty matter on the surface of the body, total disappearance of the omentum, and a peculiarly thin condition of the small intestines, which, in such cases, were so transparent, that if the deceased had taken any food immediately before death, the contents could be seen through the coats of the bowel: on one occasion (at an inquest), he was able to recognize a portion of raw green cabbage in the duodenum of a man who had died of starvation. This thin condition of the coats of the intestines he looks upon as the strongest proof of starvation. The gall-bladder was usually full, and the parts in the vicinity of it were much tinged, from the cadaveric exudation of bile: the urinary bladder was generally contracted and empty, and the heart pale, soft, and flabby; there was no abnormal appearance in the brain or lungs. Dr. Martyn assigns as a condition of the intestines diagnostic of starvation, that they are not only contracted but shrunken and diminished in size, shortened in length as well as in calibre, and like a mere cord, as if the canal was obliterated. (Med. Times and Gazette, March 30, 1851.) He met with this state in three cases: once in starvation from want of food, and twice from total obstruction to its ingestion. Mr. Fletcher found the following appearances in the cases of two children, named *Aspinall*, who died from starvation, the elder aged one year and ten months, the younger four months. In the body of the elder there was extreme emaciation, without the slighest trace of disease in any of the viscera. Some dirty creamy fluid and four cherry stones were found in the small intestines, but no distinctly fæcal matter, a few grains of which, however, were found in the large intestines. Scarcely a trace of fat was visible. In the infant the same appearances were presented, although the emaciation had not proceeded to the same extent. The evidence produced on the trial proved that the mother spent in drink the money given her for household expenses, and that the children's food and clothing were neglected The prisoners were tried for wilful murder, in accordance with the verdict of the coroner's jury. The judge ruled that the wife was in law the husband's servant, and if it were proved that he had supplied her with sufficient money, he must be acquitted; if he had not, the wife must be acquitted. The jury acquitted the man and brought in a verdict of manslaughter against the woman, who was sentenced to two years' imprisonment. (Proceedings of Liverpool Medical Society, 1855-6.) In some of these alleged deaths by starvation, ulceration of the bowels is met with. This has been considered to arise from want of food; but Dr. Donovan did not meet with it in those who died of lingering starvation. (Dublin Med. Press, Feb. 2, 1848, p. 66.)

These appearances, in order to throw any light upon the cause of death, should be accompanied by an otherwise healthy state of the body; since, as it is well known, they may be produced by many organic diseases, and death may be thus due to disease, and not to the mere privation of food. It will not, therefore, be easy to say whether the emaciation depends on disease or want of food, unless we are put in possession of a complete history of the case. On this account, in all charges of homicidal starvation, the defence generally turns upon the coexistence of disease in the body, and the sufficiency of this to account for death. See, in reference to medical evidence on this subject, the case of the *Queen* v. *Pryke*, Chelmsford Summer Ass. 1840.

The difficulties connected with medical evidence of death from starvation were well illustrated in *Reg.* v. *Mitchell* (Oxford Lent Assizes, 1861). The accused, a naval surgeon, was charged with the manslaughter of his female servant, a woman æt. 24, by withholding from her sufficient food. The evidence entirely failed to support this charge, although there could be no doubt that deceased had died either from an insufficient supply of food, or from the fact that the food which she had taken, or had it in her power to take, was not adequate to support life. The medical facts of the case were communicated to me by one of the principal witnesses for the prosecution, who saw deceased for the first time on 4th January. He found her feeble, emaciated, and suffering from exhaustion: she complained of great weakness and giddiness. There was no disease to account for these symptoms. In spite of her removal and the proper use of stimulants she died in five days (Jan. 9th). On inspection there were no appearances to account for death from natural causes. The body was much emaciated, and so light that it weighed only fifty pounds. There was no fat. The intestines were thin and transparent in parts. The stomach and small intestines were much contracted. There was an entire absence of fat from the omentum and mesentery. The gall-bladder was much distended with bile. The other organs of the body were healthy, and there was no disease in any part to account for the emaciation of the body. Two other medical gentlemen confirmed this evidence at the trial, and they all agreed that the appearances were consistent with death from starvation or insufficiency of food. The appearances were also admitted to be consistent with the non-assimilation of food. It was suggested in defence that deceased might have died from chronic diarrhœa, but there was no proof that this had existed to a degree to account for her death, and during the last five days of her life it was proved that she did not suffer from diarrhœa at all. The statement of the deceased went to show that food was not withheld from her, and the prisoner was properly acquitted. The cause of death is, however, a separate question from his alleged criminality. On this point there is no reason to doubt that the opinion given by the three medical witnesses was perfectly correct and justified by the facts which they observed. The symptoms and appearances, as well as the entire absence of any natural disease to account for them, lead to the conclusion, that deceased could not have taken sufficient food to support life, or that that which she took was not properly assimilated. In either case the symptoms and appearances would be that of death from protracted abstinence or starvation. As she was of a scrofulous habit, and of weak constitution, and the weather at the time she was first seen had been remarkably cold, it is probable that these indirect causes aggravated in some degree the effects of insufficient nutriment.

An attempt has been made to show that this could not have been a case of death from starvation, because, on the day before her death, the deceased became delirious; and delirium, it is said, is not a symptom of starvation. This may be true of some cases; but the mere occurrence of delirium was not sufficient to set aside the strong evidence furnished by the symptoms and the general condition of the body of deceased. Delirium may be the result of great bodily weakness on whatever cause depending: it is probably more rare in cases of chronic diarrhœa than in those of protracted abstinence. Too much importance must not be attached to its presence or absence on these occasions, since experience shows that there are few cases of starvation accurately observed in which the symptoms have been strictly accordant: and it would be going too far to assert that the occurrence of delirium before death would justify a medical witness in asserting that death could not have been caused by starvation, when the condition of the body and the whole history of the case allowed of no other reasonable interpretation of the facts.

Legal relations.—Starvation is commonly the result of *accident* or *homicide*; but this is a question purely for the decision of a jury; it can seldom be elucidated by medical evidence. The withholding of food from an infant forms a case of homicide by starvation, on which a medical opinion may be occasionally required. Mr. Baron Gurney held that the *mother*, and not the father, was bound to supply sustenance to an infant. The child in this case was ten weeks old, and the father was charged with wilful murder, on the ground that he had not supplied it with food. The grand jury ignored the bill under the instructions of the judge, upon the ground above stated. (The *King* v. *Davey*, Exeter Lent Ass. 1835.) But it is probable that there were particular circumstances in this case which led to this decision. The facts may be of such a nature as to inculpate the father, by proving that he was accessory to the death of the child. But where the husband and wife were charged with the murder of an apprentice to the husband, by using him in a barbarous manner, and the opinion of the medical witness was, that the boy had died from debility occasioned by a want of proper nourishment, it was held that the wife was entitled to be acquitted, as it was the duty of the *husband*, and not of the wife, to provide sufficient food and nourishment for the apprentice. (The *King* v. *Squire*. Starkie, vol. 2. p. 947.) Starvation is rare as an act of homicide, but it must not be supposed that the law implies by this the absolute privation of food; for if that which is furnished to a person be insufficient in quantity, or of *improper quality*, and death be a consequence, malice being at the same time proved, then the offender equally subjects himself to a charge of murder. Some years since, a woman who was accustomed to take parish-apprentices was tried and convicted of the murder of two children, who had died in consequence of the bad quality and small quantity of food furnished to them by the prisoner.

INSANITY.

CHAPTER 66.

LEGAL DEFINITIONS — LUNACY — NON COMPOS MENTIS — UNSOUNDNESS OF MIND. — VARIETIES OF INSANITY — MANIA — HALLUCINATIONS — ILLUSION — DELUSION — MANIA DISTINGUISHED FROM DELIRIUM — MONOMANIA — KNOWN FROM ECCENTRICITY — MORAL INSANITY — DEMENTIA — IDIOCY — IMBECILITY. — APPEARANCES AFTER DEATH. — HEREDITARY TRANSMISSION. — FEIGNED INSANITY — MODE OF DETECTION.

Legal definitions.—The law of England recognizes two states of mental disorder or alienation. 1. *Dementia naturalis* corresponding to idiocy; and 2. *Dementia adventitia*, or *accidentalis*, signifying general insanity as it occurs in persons who have once enjoyed reasoning power. To this state the term lunacy is also applied, from an influence formerly supposed to be exercised by the moon on the mind. *Lunacy* is a term generally applied by lawyers to all those disordered states of mind which are known to medical men under the names of mania, monomania and dementia; and which are generally, though not necessarily, accompanied by lucid intervals. The main character of insanity, in a legal view, is said to be the existence of *delusion: i.e.* that a person should believe something to exist which does not exist, and that he should act upon this belief. Many persons may labour under harmless delusions, and still be fitted for their social duties; but should these delusions be such as to lead them to injure themselves or others in person or property, then the case is considered to require legal interference.

Unsoundness of mind.—Besides the terms *Idiocy* and *Lunacy*, we find another frequently employed in legal proceedings, namely, "*unsound mind*"—(*non compos mentis*)—of the exact meaning of which it is impossible to give a consistent definition. From various legal decisions it would appear that the test for unsoundness of mind in law has no immediate reference to the mere existence of delusion, so much as to proof of incapacity in the person, from some morbid condition of intellect, to manage his own affairs. (Amos.) Neither condition will suffice to establish unsoundness without the other; for the intellect may be in a morbid state, and yet there may be no legal incompetency, or the incompetency alone may exist, and depend on bodily infirmity or want of education—a condition which must not be confounded with insanity. Thus, then, a person may be of unsound mind, *i. e.* legally incompetent to the control of his property, and yet not come up to the strict legal standard of lunacy or idiocy. Hence it will be seen that it is impossible, in medical jurisprudence, to give any consistent definition of insanity. A medical witness who ventures upon a definition will generally find himself involved in numerous inconsistencies. No definition can possibly comprise the variable characters which this malady is liable to assume. The power which is most manifestly deficient in the insane is generally the controlling power of the will.

Some medical practitioners have attempted to draw a distinction between *insanity* and *unsoundness* of mind. A case occurred in 1839, in which a medical man hesitated to sign a certificate for the confinement of an alleged lunatic, because in it the terms "unsound mind" were used. He said he would not have hesitated to sign it had the term "insane" been employed. The difference, if any exist, is purely arbitrary, and depends on the fact, that unsound mind is a legal and not a medical phrase, referring to an incapacity to manage affairs, which insanity in its most enlarged sense, may not always imply. The law, however, appears to admit some sort of distinction, for, according to Chitty, it is a criminal and an indictable act maliciously to publish that any person is afflicted with insanity, since it imputes to the party a malady generally inducing mankind to shun his society: although it is not libellous to say that a man is not of sound mind, because no one is of perfectly sound mind but the Deity! (M. J. 1. 351.) In reference to the refusal to sign certificates, it is however, an error to suppose that the use of one term can involve a practitioner in a greater share of responsibility than the use of the other.

Varieties of Insanity.—Medical jurists have commonly treated insanity under four distinct forms: *Mania*, *Monomania*, *Dementia*, and *Idiocy* (*Amentia*). This division was proposed by Esquirol, and although of a purely artificial nature, it is convenient for the arrangement and classification of the facts connected with the subject. In some instances there is great difficulty in assigning a particular case to either of these divisions, which is owing to the circumstance, that these states of mind are frequently intermixed, and are apt to pass and repass into each other On other occasions, a case may present characters which appertain to all the divisions. Some psychologists have proposed two subdivisions, namely, *Incoherency* and *Imbecility*; but the former is merely a mixed state of mania and dementia, while the latter is a term applied to those cases of idiocy wherein the mental faculties are susceptible of cultivation after birth, without reaching the normal standard. In a work on Medical Jurisprudence, it will be only necessary to state briefly the principal features of each of these varieties of insanity.

Mania.—In this form of insanity, there is a general derangement of the mental faculties, accompanied by greater or less excitement, sometimes amounting to violent fury. The individual is subject to hallucinations and illusions, the difference in the meaning of which terms it may here be proper to explain. *Hallucinations* are those sensations which are supposed by the patient to be produced by external impressions, although no material objects may act upon the senses at the time. (See on this subject remarks by Dr. Sigmond, Journal of Psychol. Med. 1848, p. 585.) *Illusions* are sensations produced by a false perception of objects. (Marc.) When a man fancies he hears voices, while there is profound silence, he labours under a hallucination: when another imagines that his ordinary food has an earthy or metallic taste, this is an illusion. Illusions sometimes arise from internal sensations, and give rise to the most singular ideas. When a hallucination or an illusion is believed to have a real and positive existence, and this belief is not removed either by reflection or an appeal to the other senses, the individual is said to labour under a *delusion*: but when the false sensation is immediately detected, and is not acted on as if it were real, then the person is sane. Perhaps this is the most striking distinction which it is in our power to draw between sanity and insanity. Illusions refer to the senses,—delusions to the judgment. The acts of the insane are generally connected with their delusions; but it is extremely difficult to trace the connection between them, except by their own confession. It has been remarked, that in mania there is great insensibility to changes of temperature; but it must not be inferred from this that the patient is less susceptible than a sane person of the injurious effects of cold. The death of a lunatic of the name of *Dolley*, at the Surrey Lunatic Asylum, in March 1856, was ascribed to the effects of a cold shower-bath, continued for an unusual period: this case involved a serious question respecting the medical treatment of the insane. The patient, æt. 65, was exposed to a shower-bath for half an hour, at a temperature of 45°, and, after removal from this, a full dose of tartar emetic was given to him. The man died in about a quarter of an hour, and a coroner's jury returned a verdict to the effect that death was caused by this treatment. The grand-jury threw out the bill, and *Mr. Snape*, the medical gentleman implicated, was exonerated by a medical committee, and subsequently reinstated in his office. The treatment was in this case adopted *bonâ fide*, but nevertheless, if frequently carried out to the same extent, it would expose the lives of aged lunatics to great risk. The comparative insensibility of the insane to severe injuries may give rise to a medico-legal question. This loss of sensibility has been especially noticed where paralysis is associated with the mental disorder. Cases of this kind have been recorded by Esquirol and other writers on insanity. In *Reg.* v. *Slater and Vivian* (C. C. C. Sept. 1860, the evidence for the prosecution showed that deceased, a lunatic, suffering from incipient general paralysis, died rather suddenly three days after a serious struggle with one of the attendants. There were a few slight marks of bruises on the right side of the neck and face, and there was a bruise on the abdomen. On inspection, six ribs were found fractured on the right side, and five on the left. The fractures were at a short distance from the cartilage, and were unattended with any displacement. In the abdomen there were lacerations, two inches in length, of the left lobe of the liver, and a quantity of partially coagulated blood was effused in the cavity. These injuries were undoubtedly the cause of death, but when were they inflicted? There was no evidence that the deceased had been subjected to any violence except in the struggle with the attendant three days before his death. As this was a life and death struggle, and great violence must have been used on both sides, it was considered that the cause of these injuries was sufficiently explained, and that death might have arisen from the violence inflicted by the attendant in endeavouring to escape from the attack of the lunatic. At a subsequent period, two of the lunatics confined in the same ward stated that deceased had been maltreated by the prisoners shortly before death: that they had thrown him upon the ground, pounded him with their fists, stamped on him with both feet, and then dragged him along the floor. Mr. Luke, Mr. Partridge, and Mr. Holt gave evidence of opinion to the effect that the injuries found on the body could have been inflicted only a short time before death, and that although lunatics might show an indifference to pain, yet it was impossible for such injuries to have been inflicted three days before death without the deceased exhibiting marked symptoms. The fact of so many ribs being broken would have materially affected respiration: his breathing would have been difficult, and would have attracted observation. As no symptoms were observed, they believed that the injuries, which were the cause of death, had been inflicted not more than two hours before this man died. Mr. Tyerman and Dr. Tucker, medical officers of the asylum, gave evidence to the effect that the injuries might have been inflicted in the violent struggle with the attendant, three days before death, and that the deceased might not have exhibited any indication of the injuries during the interval. It was a case of insanity attended with paralysis, and this might have rendered deceased insensible to pain. The jury acquitted the prisoners. (Winslow's Medical Critic and Psychological Journal, No. 1. January 1861, p. 91.) The power to sustain injuries and to perform acts of volition and locomotion inconsistent with ordinary surgical experience, has been elsewhere noticed (p. 330). The condition of an insane person may increase his insensibility to the effects of violence.

It is necessary that a medical jurist should be able to distinguish *mania* from delirium depending on bodily disease. *Delirium* closely resembles the acute form of mania,—so closely that mistakes have occurred, and persons labouring under it have been improperly ordered into confinement as maniacs. The following are perhaps the best diagnostic differences. A disordered state of the mind is the first symptom remarked in mania; while delirium is a result of bodily disease, and there is greater febrile excitement in it than in mania. Delirium being a mere symptom attendant on the disease which produces it, exists so long as that disease, and no longer; while mania, depending on different causes, is persistent. Delirium disappears suddenly, leaving the mind clear; while mania commonly experiences only remissions. (See Pagan, M. J. of Ins. p. 69.) In delirium there is generally great acuteness of the senses.

Monomania.—This name is applied to that form of insanity in which the mental alienation is partial. The delusion is said to be confined either to one subject or to one class of subjects. One fact is well ascertained, that monomania varies much in degree; for many persons affected with it are able to direct their minds with reason and propriety to the performance of their social duties, so long as these do not involve any of the subjects of their delusions. Further, they have occasionally an extraordinary power of controlling their thoughts and emotions, as well as of concealing the delusions under which they labour. This implies a consciousness of their condition not met with in mania; and it also appears to imply such a power of self-control over their thoughts and actions, as to render them equally responsible with a sane person for many of their acts. In a real case of monomania, it is not to be supposed that a man is insane upon *one* point only, and sane upon all other matters. The only admissible view of this disorder is that which was taken by Lord Lyndhurst, in one of his judgments. In monomania, the mind is unsound; not unsound in one point only, and sound in all other respects, but this unsoundness manifests itself principally with reference to some particular object or person. (Prichard.) There is no doubt that all the mental faculties are more or less affected; but the affection is more strikingly manifested in some than in others. I have had frequent occasion to witness this form of insanity among persons who believed that they had taken poison or were labouring under its effects, while on other points I could detect no intellectual aberration. Monomania is very liable to be confounded with *eccentricity:* but there is this difference between them. In monomania, there is obviously a change of character,—the individual is different from what he was: in eccentricity such a difference is not remarked; he is and always has been singular in his ideas and actions. An eccentric man may be convinced that what he is doing is absurd and contrary to the general rules of society, but he professes to set these at defiance. A true monomaniac cannot be convinced of his delusion: he firmly believes that his impressions are well founded, and that his acts are consistent with reason. In eccentricity there is the will to do or not to do: in real monomania the controlling power of the will is either impaired or lost. The current of thought involved in the delusion cannot be controlled or expelled. Eccentric habits suddenly acquired are, however, presumptive of insanity. The distinction of these states is of considerable importance in relation to testamentary capacity.

Many medico-legal writers consider that insanity is not necessarily confined to a disturbance of the *intellectual* powers: they hold that it may also show itself without decided *intellectual aberration* in the feelings, passions, and emotions. Thus it may appear under the form of a causeless suspicion, jealousy, or hatred of others, especially of those to whom the individual ought to be attached: and it may also manifest itself under the form of a wild, reckless, and cruel disposition. This is what has been called by Dr. Prichard "*Moral insanity*," to distinguish it from the other form which affects the mental (reasoning) powers directly, namely, "*Intellectual insanity.*" It does not appear probable, however, that moral insanity ever exists, or can exist, in any person without greater or less disturbance of the intellectual faculties. The mental powers are rarely disordered without the moral feelings partaking of the disorder: and conversely it is not to be expected that the moral feelings should become to any extent perverted without the intellect being affected, for perversion of moral feeling is generally observed to be an early symptom of disturbed reason. The intellectual disturbance may be sometimes difficult of detection; but in every case of true insanity it is more or less present, and it would be a highly dangerous rule to pronounce a man insane, when some evidence of its existence was not forthcoming. The law does not recognize moral insanity as an independent state; hence, however perverted the affections or moral feelings may be, a medical jurist must look for some indications of disturbed reason. Medically speaking, there are, according to Dr. Prichard, two forms of insanity, moral and intellectual: but in law there is only one. Moral insanity is not admitted as a bar to responsibility for civil or criminal acts, except in so far as it may be accompanied by *intellectual* disturbance. Dr. Mayo denies its existence, and contends that no abnormal state of mind should confer irresponsibility unless it involve intellectual as well as moral perversion. (Medical Testimony, p. 69.) With respect to the term monomania, it does not, according to this author, imply unity of delusion, but permanency and predominancy in some one delusion. Monomania may be accompanied with a propensity to homicide or suicide, and, according to some psychologists, with a disposition to incendiarism or theft. These forms will be referred to hereafter, in speaking of the criminal responsibility of the insane.

Dementia.—In this state there is a total absence of all reasoning power: the mental faculties are not perverted, but destroyed. There is a want of memory as well as a want of consciousness, on the part of the individual, of what he does or says. It is by no means an unfrequent consequence of mania or monomania, —but it has been known to occur suddenly in individuals, as an effect of a strong moral shock.

Idiocy. Imbecility.—Idiocy is characterized by the want of mental power being congenital. While mania, monomania, and dementia, form the "*dementia accidentalis*," idiocy forms the "*dementia naturalis*" of lawyers. This intellectual deficiency is marked by a peculiar physiognomy, an absence of all expression, and a vague and unmeaning look, whereby an idiot may in general be clearly identified. In many cases of congenital deficiency, the mind is capable of receiving a few ideas, and of profiting to a certain extent by instruction. To this state the term *Imbecility* is applied. It may be regarded as a minor degree of idiocy. The mind of an imbecile can never be brought to a healthy standard of intellect, like that of an ordinary person of the same age. The degree to which congenital deficiency of intellect exists, is generally well marked by the power of speech, or of communicating ideas by language. In idiocy there is no speech, or only an utterance of single words; in the better class of imbeciles, the speech is but little affected; while there is every grade between these two extremes. Some medical jurists have arranged imbeciles in classes, according to their capacity to receive instruction; others, according to their power of speech: but such divisions are practically without value; each case must be judged by itself. It is by no means easy to draw a distinction between the better classes of imbeciles, and those who are reputed sane,—since the minds of sane persons differ remarkably in their capacity to receive instruction. It has been well observed, that by endeavouring to make a close distinction of this kind, one half of the world might reason itself into the right of confining the other half, as insane. Persons affected with idiocy and imbecility do not suffer from hallucinations and illusions, like those who labour under mania or monomania. Idiots and imbeciles are what they always have been: there is no gradual loss or impairment of the intellectual functions. The term imbecility is often applied to that loss of mental power which takes place as a result of extreme age: but this is with greater propriety called *senile dementia*.

Such are the forms under which insanity or mental alienation may present itself to our notice. This medical classification has been adopted for the sake of convenience: because by it a practitioner may be led to form a safe diagnosis of the real state of mind of a person. It is not recognized in any of the law-proceedings connected with the insane: for in these the term *unsoundness of mind*, comprehending lunacy and idiocy, is almost exclusively employed. In adopting this arrangement, a medical jurist must take care not to fall into an error which has been sometimes committed, *i. e.* of pronouncing a person to be of sound mind, because his case could not be easily placed in any one of these four great divisions of insanity. This would be as serious an error as that formerly committed by some law-writers, namely, of giving restricted and incorrect definitions of lunacy and idiocy, and then contending that, whoever was not a lunatic or an idiot according to these arbitrary legal definitions, must be a person of sound mind.

Appearances after death. In some cases a medical practitioner may be required to state whether certain appearances found in the brain of a deceased person do or do not indicate the past existence of a certain degree of insanity or imbecility? Such a question is only likely to arise in chronic cases, in which the past existence of insanity from oral testimony may be disputed. (Case of *Stulz*, Prerog. Court, 1852.) The appearances commonly met with on an inspection are, thickening of the bones of the skull, close adhesions of the dura mater (the lining membrane), with great congestion of the pia mater, and opacity and thickening of the arachnoid membrane. There is general fulness of the blood-vessels of the brain, with remains of cysts, hardened deposits, or even abscesses in various parts of the substance of the brain. Inferences from the existence of these changes in the brain must be drawn with caution, because it cannot be said that they necessarily indicate insanity; nevertheless, such chronic changes in the brain must be considered as producing greater or less derangement of the mental functions; but the actual degree to which the impairment has existed ought properly to be determined by evidence of the conduct and actions of the deceased during life. In a communication made by Dr. Webster to the Medico-Chirurgical Society in April 1855, there is a statistical summary of the appearances met with in the examination of the bodies of 290 insane patients. In 226 cases the pia mater was infiltrated; in 207, effusion had taken place in the ventricles; in 184 fulness of the blood-vessels in the brain or membranes was observed; in 117, the arachnoid membrane was thickened and opaque; in 64, the colour of the brain appeared changed from its natural hue; in 51, the bloody points were large and numerous upon the cut surface of the medullary substance; whilst in 40 instances blood was effused, sometimes to a considerable extent, within the cranium. This effusion had evidently been the immediate cause of death in most of these patients. From these data it appears that—First, infiltration of the pia mater; secondly, effusion of fluid in the ventricles; thirdly, fulness of the cranial vessels, are the principal as also the most frequent diseased alterations of structure observed in patients who die whilst suffering under symptoms of mental disorder.

As neither the symptoms nor the duration of the insanity is given, it is difficult to apply these results to special cases. In the case of *Roberts* v. *Kerslake* (Warwick Aut. Assizes, 1854), the main question was whether certain appearances in the brain and its membranes did or did not indicate disease of long standing, as well as insanity at the particular date at which a will was made. Dr. Conolly and I considered that the appearances were not inconsistent with the supposition that the testator was sane at the time of making his will. (Journal of Psychological Med., Oct 1854, p. 573.) The reader will find some valuable information on this subject in a paper by Mr. Fisher (Med. Gaz. vol. 37. p. 657); and in another by Mr. Eccleston (Med. Gaz. vol. 47. p. 170); also in some contributions to the Journal of Psychological Medicine (1850, p. 521, and 1851, pp. 236 and 383), by Mr. Holmes Coote. See also Dr. Jamieson's Lectures, Med. Gaz. vol. 46. p. 652; and a paper by Dr. Webster, Journal of Psychol. Med. 1849, p. 483: by Dr. Farre, in the same volume, p. 533; and by Dr. Hitchman, in the volume for 1850, pp. 228, 362, 501.

Hereditary transmission.—The hereditary transmission of insanity has sometimes presented itself as a medico-legal question in relation to the criminal responsibility of the insane. According to Chitty, it is an established rule of law, "that proof that other members of the same family have decidedly been insane is not admissible either in civil or criminal cases." (Med. Jur. vol. 1. p. 352.) But recent decisions have shown that this statement is not correct. In the case of *Reg.* v. *Ross Touchet*, 1844, tried and acquitted on the ground of insanity for shooting a man, Maule, J., held that evidence that the grandfather had been insane may be adduced, after it has been proved by medical testimony that such a disease is often hereditary in a family. It was also admitted in *Oxford's* case,—the prisoner having been here tried for shooting at the Queen. (Law Times, Oct. 26, 1844.) This kind of evidence has, however, been frequently rejected, and it is not admitted in the law of Scotland. (*Gibson's* case, Edinburgh, Dec. 1844.) There can be no doubt, from the concurrent testimony of all writers on insanity, that a predisposition to the disease is frequently transmitted from parent to child through many generations. The malady may not always show itself in such cases, because the offspring may pass through life without being exposed to any exciting cause; but in general it readily supervenes from very slight causes. M. Esquirol has remarked, that this hereditary taint is the most common of all the causes to which insanity can be referred, especially as it exists among the higher classes of society. Among the poor, about one sixth of all the cases may be traced to hereditary transmission; and other authorities have asserted that, in more than one half of all cases of insanity, no other cause can be found for the malady. As we might suppose, children that are born before insanity manifests itself in the parents, are less subject to the disorder than those that are born afterwards. When one parent only is insane, there is less tendency for the predisposition to be transmitted than when both are affected: but according to Esquirol, this predisposition is much more readily transmitted through the female than through the male parent. Its transmission is also more strikingly remarked when it has been observed to exist in several generations of lineal ancestors: and like other hereditary maladies, it appears to be subject to atavism: *i. e.* it may disappear in one generation, and reappear in the next. Further, the children of drunken parents, and of those who have been married late in life, are said to be more subject to insanity than those born under other circumstances. When insanity is transmitted by hereditary descent, it appears often about the same age, under the same form, and is induced by the same exciting cause in the offspring as in the parent. This it is proper for a medical jurist to bear in mind, in examining a plea of insanity in criminal cases. (See Journal of Psychol. Med. 1848, p. 264.)

Statistics.—The valuable tables of Esquirol show that the age at which insanity most commonly attacks persons is thirty:—it rarely makes its appearance below the age of twenty, or above the age of fifty-five. According to a Report published by the Commissioners of Lunacy for 1850, there were in that year under their supervision in England and Wales, 15,079 lunatics; namely, 7074 males, and 8005 females. Of these, 11,305 belonged to the pauper class; and of the whole of the number, 7140 were confined in asylums. According to their Report, dated March 31st, 1856, it appears that on the 1st January, 1856, the number of lunatics amounted to 20,764; namely, 9701 males, and 11.063 females. Of these, 20,643 are thus accounted for. There were in asylums, 13,823; in hospitals, 1628; in metropolitan licensed houses, 2591, and in provincial licensed houses, 2601. Dr. Jamieson has published in his lectures some curious facts regarding the statistics of insanity, to which I must refer the reader (Med. Gaz. vol. 46. p. 269); and an able analysis of the Commissioners' Report will be found in the Journal of Psychol. Med. 1850, p. 111.

Feigned insanity.—Insanity is frequently feigned by persons accused of criminal offences, in order to procure an acquittal or discharge. In the first place, when this is suspected, it will be proper to inquire whether the party has any *motive* for feigning the malady. It is necessary to remember that insanity is never assumed until *after* the commission of a crime and the actual detection of a criminal. No one feigns insanity merely to avoid suspicion. In general, as in most cases of imposture, the part is over-acted; the person does either too much or too little, and he betrays himself by inconsistencies of conduct and language which are never met with in cases of real insanity. There is commonly some probable cause to which real insanity may be traced, but when the malady is feigned there is no apparent cause: in this case the appearance of the assumed insanity is always sudden; in the real malady, the progress of an attack is generally gradual, and, when the attack is really sudden, then it will be found to be due to some great moral shock or other very obvious cause. We should observe whether there has been any marked change of character in the individual, or whether his conduct, when he had no interest to feign, was such as it is now observed to be. Some difficulty may arise when fits of eccentricity or strangeness of character are deposed to by witnesses; but these statements may be inconsistent with each other, and the previous acts of the person may bear no resemblance whatever to those performed by him in the recently assumed condition. A difficulty of this kind rarely presents itself, since, in an impostor, no act indicative of insanity can be adduced for any antecedent period of his life: it is only *after* the perpetration of a crime and its detection, that any action approaching to insane habits will be met with. In real insanity, the person will *not* admit that he is insane; in the feigned state, all his attempts are directed to make you believe that he is mad; and an impostor may be induced to perform any act, if it be casually observed to another in his presence that the performance of such an act will furnish strong evidence of his insanity.

I am indebted to a learned judge for the following note on feigned insanity:—"It may be safely held that a person feigning insanity will rarely, if ever, try to prove himself to be sane—for he runs the great risk of satisfying others that he is sane—the conclusion he desires to avoid. There is no better proof, in general, that the insanity (supposing other evidence of it to be strong) is real, than in the keen and eager attempts by the accused to prove that he is sane, and strong and indignant remonstrances against being held to be insane, although that would protect himself against trial and punishment. In one case at Edinburgh some doubt existed whether a party was feigning insanity; and some of those about him, and in charge of him in gaol, from his clearness and coherence, were satisfied that he was quite sane, and that what he exhibited was merely eccentricity or simulated attempts to act as a madman. Insane he certainly was, beyond all doubt; but he fought the point of his sanity most bravely in Court, he made very clear and quick remarks on the evidence of the medical men, who had no doubt of his entire insanity: and, when one physician of great experience with insane persons stated that he thought him quite incapable of giving information to counsel and agent for conducting his defence, he said instantly, 'Then why did you advise me to apply to, and see, counsel and agents?'"

Mania is perhaps more frequently assumed than any other form, because the vulgar notion of insanity is, that it is made up of violent action and vociferous and incoherent language; but mania rarely comes on suddenly, or without an obvious cause. The patient is also equally furious by day and by night, while the impostor is obliged to rest after his violent exertions. Dr. Burrows recommends that close attention should be paid to the expression of the eye. The mobility of the features may be as rapid as the imagination is vivid; but when every feature may vary or be kept under control and be steady, the eye will still indicate the erring thought. Its expression cannot be easily assumed. In mania the person sleeps but little, and the sleep is disturbed; an impostor sleeps as soundly as a healthy person:—the violence of the maniac continues whether he is alone or not; while the impostor acts his part only when he thinks he is observed: hence the imposition may be detected by watching him when he is not aware that an eye is directed upon him.

Some stress has been laid on the fact that assumed insanity commonly appears suddenly and without probable cause; but while this may be allowed to have a general value in forming a diagnosis, it is proper to bear in mind that the actual commission of a crime has sometimes suddenly led to an attack of mania in a previously sane person. Dr. Pagan has related a singular instance of this kind. Two men were committed to prison on a charge of theft, and the officers requested a poor man, who was a shoemaker, to assist them in conveying the prisoners. This man took a gun with him for better security. During the journey one of the prisoners leaped from the cart and ran off. The officers called to their assistant to fire, and he, thinking himself warranted to do so, fired, and wounded the prisoner severely in the back and loins. The man who fired the gun was himself immediately committed to gaol as a criminal, and the event made such an impression upon him that he became violently maniacal. When scarcely recovered he was tried for the offence, and it was supposed that he was feigning insanity. He was convicted and sentenced to six months' imprisonment. (Med. Jur. of Ins. 82.) This case proves that a person may really be attacked by mania under circumstances in which a justifiable suspicion might arise that he was feigning.

The feigning of *Monomania* would be a matter of some difficulty, and easily susceptible of detection. *Dementia* is more easily feigned. In general this state comes on slowly, and is obviously dependent on organic changes, as old age, apoplexy, paralysis, or hemiplegia, or it is a consequence of long continued mania or monomania. As this form of insanity consists in an entire abolition of all mental power, so the discovery of any connected ideas, reasoning or reflection either by language, writing, or gestures, would at once show that the case was not one of real dementia. *Idiocy* and *imbecility* could hardly be feigned successfully, because these are states of congenital deficiency; and it would be easy to show, by reference to the past life of a person, whether he had or had not always been such as he represents himself. The difficult cases of feigned insanity are really limited to those forms of the malady which are liable to attack an individual suddenly. In a sudden attack of real insanity there should be some obvious cause. The non-existence of this, with the presence of a strong motive for deception, will always justify a suspicion that the malady has been assumed.

At the Lewes Winter Assizes, Dec. 1856 (*Reg.* v. *Ball*), the prisoner, a ticket-of-leave convict, was convicted of house-breaking, and sentenced to fifteen years' transportation. The case of this convict shows how easily medical men may be deceived by skilful impostors who feign insanity. After the prisoner had been committed to gaol he simulated madness so successfully that he deceived three of the visiting justices and two medical men; and a certificate was about to be signed for his removal to a lunatic asylum, when the deception was discovered by the man having made a confidant of one of his fellow-prisoners. He had been convicted of robbery at Leicester in 1851, and sentenced to ten years' transportation. He was sent to Millbank prison, where he feigned insanity and succeeded in deceiving the medical officers, who certified that he was a lunatic, and he was accordingly removed to Bethlehem Hospital, where he remained two years. He subsequently received a ticket-of-leave. For a singular case in which a verdict was returned against strong medical evidence of alleged insanity see Lancet, January 18. 1845, p. 70; Med. Gaz. vol. 47. p. 49; Journ. Psychol. Med. 1848, p. 277; also, Ann. d'Hyg. 1829, vol. 2. pp 367, 376, and a case by Dr. Bayard, Ann. d'Hyg. 1847, vol. 2. p. 230.

CHAPTER 67.

MEDICO-LEGAL QUESTIONS IN RELATION TO THE INSANE—IMPOSITION OF RESTRAINT—ILLEGAL IMPOSITION OF RESTRAINT—VIOLENCE OF TEMPER—CERTIFICATES OF INSANITY—RULES FOR THE DISCHARGE OF LUNATICS.

Medico-legal questions.—Among the questions which may come before a medical jurist, in relation to the subject of insanity, are the following:—A practitioner may be required to say whether a person affected with the malady should or should not be confined in a lunatic asylum—whether he should be deprived of his civil rights by interdiction, or whether he is so completely cured of his malady as to justify his liberation from confinement. Then, again, medical evidence may go far to determine whether a will or deed, executed by an alleged lunatic, should be set aside; whether a marriage-contract should be annulled; and, lastly, whether a criminal act was committed by a person labouring under insanity—a question involving either the life or, according to circumstances, the perpetual imprisonment of an accused party.

Imposition of restraint.—By this we are to understand the separation of a lunatic from his friends or relatives, with or without the confinement of his person by force. What are the circumstances which will justify a practitioner in applying restraint to the insane? The law has given great power in this respect to members of the medical profession, but, owing to certain abuses, this power has been of late years much restricted by various acts of the legislature. Most medico-legal writers agree that we are never justified in ordering restraint, except when *from the symptoms* we have reason to apprehend that *the lunatic will injure his person or property*, or *the persons or property of others*. It is then not sufficient to seek merely for evidence of *delusion*: but, if we discover that the individual labours under some delusion, it is our duty to consider how far this may prospectively endanger the well-being of himself and his friends. Unless the delusion be such as to render it probable that his own interests or those of others may be damaged by his insane conduct, careful and judicious superintendence will answer all the purposes of the closest restraint. (For some remarks on this subject, see Med. Gaz. vol. 44. p. 1061.) Some have justified the act of resorting to restraint on all occasions, on the principle that it may tend to the cure of a patient by removing the delusion. In this point of view the subject has no relation to legal medicine. It may be urged with more plausibility, that by withholding restraint in incipient cases, mischief may be done by the lunatic to himself or others, and that then it will be too late to interfere; but even here proper superintendence will render close confinement unnecessary. A medical practitioner must not be too ready to lend himself to the signing of certificates for the confinement of persons who may be labouring under harmless delusions. In violent mania, or in monomania with a homicidal or a suicidal propensity, there can be no doubt of the propriety of applying some degree of restraint, for here the necessity is imminent. If a remarkable change has suddenly taken place in the character of a patient; if he has become irritable, outrageous, or threatened personal violence to any one, or if he has recklessly endangered the interests of himself and family, he is undoubtedly a fit subject for restraint. (See Pagan, Op. cit. p. 75.) The more he approaches to this condition, the less difficulty we shall have in coming to a decision, and in a really doubtful instance there will be no impropriety in employing restraint; since, although the person is thereby deprived of liberty, it is better that this should happen, than that he or his friends should incur the risk of suffering severely by his insane conduct.

The forcible removal of a person from his home to a lunatic asylum, unless the circumstances are of such a nature as to render immediate interference necessary on the ground of admitted or proved insanity, is unjustifiable in law, and may involve those concerned in the removal in a serious responsibility. The case of *Nottidge* v. *Ripley* (1849) is in this respect of some interest. A young lady of fortune was here clandestinely and violently removed from a place to which she had voluntarily retired; examined by two medical witnesses nominated by those who had thus forcibly removed her; and then closely confined in a lunatic asylum for seventeen months, without being allowed to communicate in any way with those members of her family who alleged that she was not insane, and who through these tortuous proceedings were unable to discover the retreat of their relative, and to have the case publicly investigated. At the trial for this abduction, the jury returned a verdict against those who were charged with the offence. (Med. Gaz. vol. 44. p. 974.) The allegation of insanity was denied, although it was proved that the plaintiff had fallen into the hands of persons whose object was obviously to possess themselves of her property, and that, like her sisters, she had adopted some absurd and pseudo-religious notions. If, however, such violent measures were sanctioned before any preliminary inquiry, medical or otherwise, were instituted into the state of a person's mind, and upon the mere opinion of non-medical persons or interested relatives, no individual, whether sane or insane, could be assured of his liberty. This case has called forth some criticisms which the reader will do well to peruse. (See Journ. Psychol. Med. 1849, p. 564; and 1850, p. 14.) In *Hill* v. *Philp* (Exchequer, Feb. 1852), an action was brought by plaintiff to recover damages for alleged neglect and unskilful treatment on the part of the defendant while under his care as a lunatic patient. The plaintiff was examined, and he wished to impress the Court that he was then perfectly sane. His cross-examination, however, elicited the belief that "he was descended from Leofric, the wise Earl of Mercia, who was contemporary with Edward the Confessor." It was also proved that he had called for water from Jerusalem and the Jordan! In short, there was abundant evidence of insanity, and the jury returned a verdict for the defendant. The case, however, conveys an important caution that medical men should be careful in the imposition of restraint, as from the evidence it appeared that unnecessary violence had been used on this occasion. There is another circumstance which renders this case of importance to medical practitioners: it involved the question whether in the treatment of a lunatic, a medical man can justify the imposition of restraint by the allegation that he acted under the directions of, or upon the request of, the wife or other relative, at whose instigation the lunatic may have been confined. In *Hill* v. *Philp*, the judges decided that a medical man, under such circumstances may act upon the directions of a wife, but that the directions must only be considered as guiding his judgment, and not as absolutely dictating to him and justifying his proceedings; that he is still bound to exercise his own discretion so far as to refrain from doing anything, or adopting any course, which might be injurious to the patient. A medical man is, therefore, ultimately responsible for his treatment of a lunatic. No person can give him authority to do that which is not in accordance with general practice or the necessity of the case. (For a report of this case and some judicious remarks upon the decision, see the Legal Examiner, May 29, 1852, pp. 307, 318.)

In order to provide for the protection of lunatics and the prevention of undue violence or frequency in the application of restraint, the law compels the keepers of asylums to enter in a book a report of each case or of each occasion on which any mechanical restraint is resorted to. An omission to make this entry is a misdemeanour: and at the Maidstone Lent Assizes, 1851, two medical gentlemen were convicted and fined for placing patients under restraint without having made the proper entries required by law. (*Reg.* v. *Maddock.*) See also Med. Gaz. vol. 47. p. 556; and a paper on the use and abuse of restraint, Journ. Psychol. Med. 1849, p. 240.

Violence of temper must not be taken as a proof of insanity. A man may have always had a violent temper, subject to occasional fits of aggravation; but this should not be confounded with mental disease. In order to determine whether the acts of a person are due to violent temper or insanity, it will be proper to ascertain what may have been his natural habits. The great feature of insanity is *change of character*: a man who is really insane is different from what he has previously been; but it may be proved of a violent-tempered man, that he has always been the same. The greatest abuses of the restraint system have been chiefly observed in cases of monomania, where persons have been forcibly imprisoned because they entertained some absurd and harmless delusions, over which they had so great a control as to render it somewhat difficult even for a shrewd and experienced examiner to detect their existence. When, at last, after many hours' cross-examination, the existence of delusion has been made apparent, the result has been looked upon as furnishing matter for triumph and exultation; but, as Dr. Conolly justly remarks, one point in these cases appears to have been wholly lost sight of, namely,—What possible injury could have resulted to the patient or his friends from the existence of a delusion over which he had such complete control and mastery as to render it a most laborious task to obtain any evidence of its existence? (Indic. of Ins.) It may be freely admitted, that, when delusion on any subject really exists, there is reason to suppose that the mind must be more or less disordered in all its faculties; but such patients require close watching, not a rigorous imprisonment in an asylum. The greatest danger is to be apprehended in those cases in which there is the least power of self-control.

Certificates of insanity.—It will here be necessary to state the circumstances which require the attention of a practitioner when he is called upon to sign a certificate of insanity, whereby a person may be placed in confinement in an asylum. The Acts which specially refer to this subject are the 16th and 17th Victoria, c. 96 and 97. These Acts, which came into operation on the 1st of November 1853, are a consolidation of the statutes on the regulation of the care and treatment of lunatics. Their provisions are very stringent, both with respect to medical men who sign certificates, and those who keep asylums for the reception of lunatics.

According to s. lxxiv. c. 97. no person (not a pauper) can be received into or detained in any asylum, without an order from some person, and two medical certificates, which must be signed *by two physicians, surgeons, or apothecaries*, not in partnership or an assistant to the other, and each of whom shall *separately from the other* have personally examined the person to whom it relates not *more than seven clear days previously* to the reception of such person into such asylum.

Form of medical certificate in the case of private patients:—

I, the undersigned, being a (duly registered) physician *or* surgeon *or* apothecary [*here set forth the qualification*], and being in actual practice as such, hereby certify that I, on the day of , at [*here insert the street and number of the house (if any), or other like particulars*],[†] in the county of, &c., separately from any other medical practitioner, personally examined A. B., the person named in the accompanying statement or order, and that the said A. B. is a lunatic [*or* an idiot, *or* a person of unsound mind], and a proper person to be taken charge of, and detained under care and treatment, and that I have formed this opinion upon the following grounds, viz.:—

1. Facts indicating insanity observed by myself [*here state the facts.*]

2. Other facts (if any) indicating insanity, communicated to me by others [*here state the information, and from whom*].

(Signed) Name.
Place of abode.

Dated this day of , one thousand eight hundred and

Under s. x. c. 96. no person can be received into any registered hospital or licensed house, or as a single patient, under any certificate which purports to be founded only upon facts communicated by others. A medical certificate may be amended if incorrect or defective. No medical man can receive as a boarder in his house any insane person, whether for medical treatment or otherwise, unless he has previously obtained a license from the Commissioners of Lunacy, and one certificate duly signed by two other medical men. In January 1861, a medical practitioner was convicted of misdemeanour for thus receiving illegally a lunatic patient. (*Reg.* v. *Kelly*, C. C. C. Jan. 29. 1861.) This was a clear breach of the regulations. The defence was that he was ignorant of the law, but this was no answer to the charge. (Med. Times and Gaz. Jan. 28. 1861, p. 105, and Lancet, Feb. 9. 1861, p. 151.)

By s. xiii. c. 96. a medical practitioner who gives false certificates, or any person not being a registered physician, surgeon, or apothecary in actual practice, who gives certificates as such, is declared to be guilty of a misdemeanour. For any act done by a registered medical practitioner contrary to any of the provisions of the Act (although not declared to be a misdemeanour) he is subjected for each proved offence to a penalty of twenty pounds. By s. xxxvi. c. 96. the words "physician," "surgeon," or "apothecary," shall respectively mean one duly "licensed to practise as such by, or as a member of, some College, University, Company, or Institution, legally constituted and qualified to grant such authority or licence in some part of the *United Kingdom*, or having been in practice as an apothecary in *England or Wales* on or before the first day of August 1815, and being in *actual* practice as such physician, surgeon, or apothecary." (16 and 17 Vict. cap. 96. s. xxxvi.) Thus the certificates of Irish medical practitioners are valid for the confinement of lunatics in England, and conversely those of English practitioners are valid for the asylums in Ireland. A special Act has been passed for Scotland, 20 and 21 Vict. c. 71. By sections xxxiv. and xxxv. the rules regarding certificates are similar to those of the English statute. Under the new statute there is a technicality which it is desirable to point out, as it may affect the validity of a medical certificate. The act expressly requires that the number of the house and the name of the street where the examination is made should be specified in the certificate, as well as the residence, profession, or occupation (if any), of the person examined. In a case (*Re Greenwood*) which came before Mr. Justice Coleridge on a *habeas* for the discharge of an alleged lunatic (February 1855), the medical certificate for the confinement of Greenwood was set aside owing to this informality. There appears to have been considerable doubt about this gentleman's state of mind. Two physicians made affidavits that he laboured under unsoundness, while two others gave their opinion that he was mentally sound. The late Serjeant Wilkins then took an objection that, under the Act, the number of the house and the name of the street where the examination took place should be mentioned in the medical certificate. That had not been done in this instance, and Mr. Greenwood was therefore not in legal custody. Coleridge, J., in giving judgment, said, it was stated in the certificates that the examination had been made at Blackburn, but the examiners omitted to state the street; and the affidavit showed that Blackburn was a large and populous place. The statute prohibited the reception of any lunatic without medical certificates according to a form in the schedule to the Act, which directed the insertion of the name of the street, and the number of the house in which the examination took place. It was not agreeable to decide on a formal objection when the defect had no influence on the merits, and that might be said in the present case: but decisions were precedents, and here the words were express, and if one thing might be omitted so might others, and all the forms were with a view to the protection of the lunatic. If it were asked, of what benefit was such a peculiarity?—it might be answered that the Court had no business to consider that question, but this form might be a matter of importance in order to prevent improper examinations. He had come to the conclusion that the certificate was defective. If the party had been shown to be in a dangerous condition it would have been the duty of the Court to interfere. Upon the facts, Mr. Greenwood might be of most impaired memory, or might not be able prudently to govern a household, but it was clear he was harmless to himself and others. Mr. Greenwood would therefore be discharged.

It will be observed that every medical practitioner signing these certificates is required to specify the *facts upon which his opinion is formed*, and whether such facts are derived *from his own observation* or from the information of any other person.

The 74th section of cap. 97, provides that in cases of emergency a person (not a pauper) may, under special circumstances (these being stated in the order), be received into a house or hospital upon a certificate signed by *one* medical practitioner only, provided that within *three days* two other such certificates are signed by two other medical practitioners not being connected with such house or hospital, upon a like examination. The detaining of a person upon one medical certificate only, beyond the period of three days, without such further certificates, is a misdemeanour in the keeper of the house or hospital. By s. lxvii. c. 97, the certificate of *one* medical practitioner only, signed according to the above rules, will suffice for a *pauper lunatic*, provided the party has been previously examined by a justice, clergyman, and overseer, or relieving officer. By s. xii. c. 96, no medical practitioner who is interested in or attends a licensed house or hospital, or whose father, brother, son, partner, or assistant, is wholly or partly the proprietor of, or a regular professional attendant in, such house or hospital, shall sign any certificate for the reception of a patient into it. It is obvious from the terms of the Act, that one person cannot sign a certificate as a substitute for another, and yet there have been several instances of its violation under these circumstances. In December 1855, a medical assistant was committed for trial because he had signed the name of the surgeon with whom he was living, to a certificate of insanity for the confinement of a pauper lunatic. There was no doubt about the insanity of the person, and the plea urged in defence was, that the surgeon whose name was thus forged was in ill-health and had given the assistant an authority to sign papers for him. This, however, was no justification of a violation of the terms of the Act. The words of the certificate are so explicit on this point, that no reasonable person can have any doubt about their meaning.

As ignorance of the law is not allowed to be an excuse for its violation, so a medical man, unless acquainted with all the particulars above mentioned, may easily subject himself to a prosecution; and he is not likely to be spared the disgrace and mortification attendant upon this, should it happen that the case is of a doubtful nature. The law expressly requires from each medical man a separate visit, a separate personal examination of the alleged lunatic, and a separate medical certificate setting forth the *special fact or facts*, whether observed by himself or derived from the information of others, upon which his opinion is based. Dr. Conolly has shown that there are strong objections to the present severe restrictions regarding these certificates. (Journal of Medical Science, April 1861, p. 127.)

Specification of facts.—Medical practitioners have had some difficulty in assigning the fact or facts upon which their judgment of the insanity of a party was based. (Med. Gaz. vol. 36. p. 1434; and vol. 37. p. 485.) What will constitute the description of a fact to render the certificate valid? This important question was raised and decided in the case of *Shuttleworth* (Queen's Bench, Nov. 17. 1847.) An application was made for the discharge of a lunatic on the ground that the medical certificates did not set forth the *facts* from which the opinion of those who signed them was derived. In one, it was stated that the lunatic laboured under a *variety of delusions*, and that she was *dirty and indecent in the extreme*. In the other the certifier stated that he had formed his opinion from the *conversation* which he had that day had with her. It was contended that the statement in the first certificate was not so much a fact as a conclusion drawn from other facts which ought to have been mentioned in the certificate itself. Lord Denman, in giving the judgment of the Court, held that the certificates were valid:—that it was not necessary to have all the delusions of an insane person stated in the certificate. The statement that the lunatic was dirty and indecent in the extreme was *primâ facie* sufficient to justify the imputation of insanity, even if the certificate did not state that the patient laboured under a variety of delusions. The allegation that the opinion respecting insanity was founded upon a conversation with the alleged lunatic was also sufficient to render the certificate valid.

(Med. Gaz. vol. 38. p. 932; also Law Times, Nov. 21, 1846, p. 145.) Hence it follows that a general statement of the circumstances which have led to the belief of the insanity of a party, will be a sufficient compliance with the provisions of the statute to render a certificate valid. Dr. Millar advises that a medical man should at all times avoid giving as a fact indicating insanity, any delusion which might in reality be founded in truth. (Hints on Insanity, 1861, p. 78.) His work contains some useful suggestions on the construction of medical certificates. A medical man must take care to draw a clear distinction between the *facts* observed by *himself* and facts communicated by *others*. Any certificate may become at a future time a subject for close and hostile criticism. In a case referred to by Dr. Bucknill, one of the medical men certifying to the insanity of a gentleman, who was at that time undoubtedly insane, had stated as facts *observed by himself*, that "his (the patient's) habits were intemperate, and that he had squandered his property in mining speculations." But on cross-examination in the Queen's Bench, he was obliged to confess that the only act of intemperance he had actually observed, was the patient's drinking one glass of beer, and that the squandering of property was the loss of what was to him a mere trifle, in a mining speculation, which eventually turned out to be a very good one. (Millar's Hints on Insanity, 1861, p. 187.) Counsel properly hold a medical practitioner strictly to the common and accepted meaning of the words which he uses. Hence the greatest caution should always be observed in the language employed in these certificates. A practitioner will be held responsible for the slightest exaggeration or mistatement. The terms of the certificate are sufficiently explanatory: and any violation of them may subject a practitioner to a trial for a misdemeanour. In June 1848, a surgeon was tried and convicted at the Central Criminal Court of having certified that he had examined a female lunatic on the *day* on which he put his name to the document, when he had not seen her for two or three months. There was no doubt of the insanity of the party, but as this was an untrue statement, he was convicted of the offence.

Discharge of lunatics.—In forming an opinion relative to the propriety of discharging a person who has once been confined as a lunatic in an asylum, it is proper to examine the particulars of his case with the same caution as if the object were to confine him for the first time. The question of liberation is commonly restricted, like that of restraint, to cases of mania and monomania. It may so happen, that an individual has a lucid interval at the time of examination, in which case it will be necessary to make more than one visit. One who has been guilty of a heinous crime like murder should never, on any pretence, be discharged. There are often long lucid intervals in homicidal mania: and it is impossible to be certain that the disease is entirely removed. If the individual has manifested the least disposition to suicide, we should be extremely cautious of liberating him; for suicidal mania is often artfully concealed under a cheerful exterior. We cannot always test the propriety of granting liberation by the lightness of the offence for which a criminal lunatic has been confined. The circumstances under which the most trifling offence has been committed, may show that the mind is wholly unsettled with regard to moral responsibility: and such lunatics can never be trusted, even when there is great improvement in their language and deportment. The unhappy result of prematurely discharging a criminal lunatic was seen in the case of a man named *Thom*, otherwise styling himself Sir William Courtenay. He was shot while rioting with many others near Canterbury, in June 1838. The whole life of this man seems to have been made up of a mixture of eccentricity and insanity. He was guilty of the most flagrant perjury, was tried, found insane, and confined as a lunatic. After the lapse of about six months it was thought that he was so much improved as to allow of his discharge; although, even at this time, it appears that he fancied himself to be the Saviour! On his discharge he was guilty of many extravagant acts; he collected a number of ignorant persons as his followers, and infected them with his delusion. He resisted the military who were sent to apprehend him, and eleven lives were lost on the occasion. A medical man cannot always be responsible for unfortunate consequences of this kind; but this and other similar instances show that great risk is incurred in hastily allowing the discharge of a lunatic who has once been guilty of a crime, however slight, so palpably depending on a disordered mind. The 16th and 17th of Victoria, c. 97, has placed certain restrictions on the power of liberating lunatics. Under ss. 83 and 84, the person originally signing the order which is required in addition to the medical certificates, may write an order for the discharge or removal; but, under s. 85, this order is of no effect, if a medical practitioner certify that in his opinion such patient is dangerous and unfit to be at large, together with the grounds on which his opinion is founded, unless the commissioners or visitors shall, after the production of such certificate, give their consent in writing for the removal or discharge of such patient. Under other clauses, additional powers of discharge are given to the commissioners and visitors, subject to such restrictions as to leave the control for the most part in the hands of professional men. These powers of discharge do not, however, apply either to criminal lunatics, or to those found insane under a commission issued by the Lord Chancellor.

CHAPTER 68.

TESTIMONIAL CAPACITY OF LUNATICS.—INTERDICTION—COMMISSIONS OF LUNACY—EXAMINATION OF ALLEGED LUNATICS—MEDICAL AND LEGAL TESTS OF COMPETENCY—LUCID INTERVALS.

Testimonial capacity of lunatics.—A question of some importance has arisen regarding the admissibility of the testimony of lunatics concerning facts which they allege they have witnessed. In *Reg.* v. *Hill*, tried at the Central Criminal Court in the spring of 1851, the evidence of a man named *Donnelly* was tendered on the part of the Crown. (Jour. of Psychol. Med. 1851, pp. 279 and 436.) This man was a pauper lunatic, and was confined as such in the same ward with the deceased, who, it was alleged, had been maltreated and killed by the prisoner. It was quite clear from the cross-examination of Donnelly at the trial that he laboured under insane delusions,—that he was constantly visited by spirits, &c.: but, nevertheless, he gave a clear and consistent account of the mode in which deceased was treated by the prisoner; and although he firmly believed in the existence of spirits and their power of communicating with him, he appeared to have a full knowledge of the difference between truth and falsehood. His evidence was received, and upon this the prisoner was convicted. The case was subsequently argued in the Exchequer Chamber before all the judges, and decided in favour of the admissibility of the evidence. It may now, therefore, be considered as settled that a lunatic who labours under delusions, but who, in the judgment of a medical practitioner, is capable of giving an account of any transaction that happened before his eyes, and who appears to understand the obligation of an oath, may be called as a witness. (*Reg.* v. *Hill*, 2 Denison's Crown Cases, 254.) The rule laid down by Lord Wensleydale is in accordance with this view: it is for the judge to say whether the witness is admissible, and then his credibility is a question for the jury. As old legal dicta on the subject, we find the following:—"An idiot shall not be allowed to give evidence (Co. Litt. b. 6; Gilb. Evidence, p. 144), nor a lunatic (*ib.*), except during a lucid interval" (Archibold, Pleading and Evid. in Crim. Cases, p. 124): but it is now known and admitted that the shades of insanity are infinite,—that some lunatics are as fully competent to observe and remember facts, and to understand the obligations of an oath, as persons who are sane; hence, therefore, incompetency to give testimony must not be inferred from a mere name assigned to a malady, but it must be decided by the special condition of the lunatic. Under any other view, crimes of the greatest enormity might be perpetrated in lunatic asylums, where the only witnesses must generally be lunatics, without the possibility of convicting the criminals. It has been appropriately remarked by a good authority that the fact of incompetence to testify is not necessarily connected with a state of insanity; that it would be far more correct to consider it an independent fact to be established by a distinct order of proofs. The truth is, an analogy in a medico-legal sense has been too hastily assumed between the act of testifying and that of performing business contracts and other civil acts; and, in consequence, it has shared with them in the same sentence of disqualification without an attempt to ascertain the kind and degree of intellectual power which they respectively require. (Ray, Medical Jurisprudence of Insanity; also Medical Gazette, vol. 47. p. 150.) In the spring of 1852 I saw Donnelly, the witness in the above case, in the Colney Hatch Lunatic Asylum. His powers of observation and reasoning were very acute and quite sound, except when reference was made to his peculiar delusions regarding spirits. In another case, on appeal at the Middlesex Sessions in December 1852, the testimony of a lunatic was admitted, and he proved the facts of the respondent's case. The resident medical officer testified that the patient had a good memory, and could speak correctly to facts that had occurred before he became insane. In *Reg.* v. *Coggle* and others, tried before Lord Campbell at the Nottingham Lent Assizes, 1856, this kind of evidence was received on a trial for felony. The prisoners were charged with highway robbery, and the prosecutor could not clearly speak to their identity. A man named Bourne witnessed the transaction and swore positively to two. Previous to the trial he was attacked with insanity, and was then confined in an asylum. He was produced as a witness, and gave his evidence in a clear and calm manner. It was received, and upon it chiefly the prisoners were convicted. In *Reg.* v. *Slater* and *Vivian*, C. C. C. Sept. 1860, the evidence of two lunatics was received, but their statements were uncorroborated, and the jury, by their verdict, rejected their evidence.

Interdiction. Commissions of lunacy.—By interdiction we are to understand the depriving of a person labouring under mental disorder of his civil rights; in other words, preventing him from exercising any control or management over his affairs. It may be with or without restraint, for one condition does not necessarily imply the other. When an individual, from mental incompetency, is liable to be imposed upon by others, or is guilty of foolish and extravagant acts, whereby his property is damaged, a Commission is commonly granted by the Court of Chancery, in order to determine whether he be "*compos*" or "*non compos mentis.*" This writ is well known under the name of "*de lunatico inquirendo.*" Before it can be issued it is necessary, among other matters, that there should be affidavits, made by two or three physicians or surgeons, certifying to the insanity of the party. It has been already explained that the object of the law is to determine whether the incapacity to manage affairs be owing to some *mental* defect or disorder, and not merely to want of education or bodily infirmity—otherwise all wealthy minors and infirm persons might be improperly deprived of the control of their property. It is unfortunate that these commissions have been hitherto conducted on so expensive a scale as to render them applicable only to the wealthy classes of society; and even here the expenses attending such a simple inquiry as that for which the commission is issued are often of the most ruinous kind, and the results are by no means satisfactory. (See the cases of *Mr. Davies*, *Miss Bagster* (July 1832), of *Lady Kirkwall* (Feb. 1836). *Mrs. Cumming* (1846), and others.) By a new regulation, the Lord Chancellor has it in his power to direct an inquiry before one or two commissioners, in which case a jury is dispensed with. Evidence may thus be received, and the decision left with the commissioner or commissioners so appointed. The costs of an inquiry are by this regulation greatly reduced. This form of proceeding was adopted in reference to the *Earl of Kingston* (April 1861) and the Master (Warren) speedily brought to a close, by his decision, a case which might, under the old system, have been protracted for two or three weeks. A Bill is now before the House of Lords (May 1861) conferring a power on the Lord Chancellor, on the report of a Master in Lunacy, to make orders regarding the disposition of the property of lunatics of small incomes, and to dispense with the expensive ordeal of a writ *de lunatico*.

One source of difficulty on these occasions is that medical witnesses are allowed to be summoned by both parties, and the opinions given often exactly neutralize each other. They are hereby converted into partisans and are retained in the cause, as much as if they were counsel. It has been well remarked that a man, even unknown to himself, with the purest intentions and the most perfect rectitude, will insensibly lean to the side on which he has been consulted. (Pagan, p. 301.) The public are apt to infer, from such conflicting opinions emanating from men of equal experience, that the difference cannot depend essentially on the *medical* facts of the case; and that the question might be better determined by non-professional persons. See the case of *Carpenter*, Dublin Med. Press, July 16, 1845, p. 46: also that of *Mrs. Cumming* (1846), in which the conflict of medical testimony was even greater than usual. This inquiry lasted sixteen days, and cost five thousand pounds! In fact, a large portion of this lady's property was spent in determining by a verdict that she was insane; and there was an intention that the remainder should be expended in reversing the decision, when the unfortunate lady died! [The reader will find a report of this remarkable case in the Journal of Psychological Medicine for April 1852.] A remedy for this serious evil would be, that medical witnesses on such occasions should be appointed, like the commissioners, by the Chancellor, and they would be thereby made perfectly independent of both parties. At present they rather occupy the position of medical counsel than medical witnesses; for it is quite clear that no one would be summoned by a solicitor whose views did not coincide with those of the party summoning him; and it is an opinion among some solicitors, for which, unfortunately, there is apparent reason, that medical evidence on these occasions is a marketable commodity, and may be purchased at graduated prices! There are some medical men who appear to think that on these occasions they are justified in sinking the witness in the advocate, and that they are bound by a sort of duty to make the best of the case for the person who retains them: but this is a mistaken view of their position. An advocate is not bound by an oath to state "the truth, the whole truth, and nothing but the truth;" but a scientific witness is placed under this sacred obligation, and it is a duty which he owes to his profession and to society that he should lay aside all personal bias. It may appear an innocent matter to suppress certain facts and to exaggerate the importance of others, in order to induce a jury to pronounce one whose mental soundness is in question to be perfectly sane and competent: but the same mercenary zeal which would thus lead to the civil freedom of an insane person, might, on another occasion, be employed in unjustly depriving a sane person of his liberty. The confidence of the public in medical opinions is already much shaken; and it would be altogether destroyed, and such opinions dispensed with, if it were once known that a medical man on these occasions accepted a retaining fee not to speak the whole truth, but rightly or wrongly, to give evidence in favour of the party who consulted him Whatever may be the nature of the case, experienced solicitors know that if they only search far enough they will generally fall upon some medical witnesses who will adopt their views. (The reader will find some remarks on this subject in the Medical Gazette, vol. 5, p. 719; vol. 11. p. 740; and vol. 17. p. 816.) An improved course of proceeding was adopted in *re Taylor* (April 1857). This gentleman had been examined by seven medical men, three of whom pronounced him to be of unsound mind, and four declared him to be perfectly sane, but with an impaired memory. There was here a majority of one in favour of sanity. The Lords Justices, on this, deputed Dr. F. Winslow to examine and report on the condition of the lunatic for their special information. He reported in favour of soundness of mind, admitting the existence of defective memory, partly arising from age. The decision of the Court was in accordance with this view.

The law of Scotland has, in this respect, the advantage of that of England in simplicity and justice. A factor is appointed, on the application of relatives, to take charge of the property. Notice is given to the alleged lunatic, so that he may, if he pleases, oppose the appointment. Medical evidence is received, and upon this the decision of the Court is chiefly based. The appointment, if made, can at any time be revoked upon good and satisfactory grounds.

Examination of alleged lunatics.—To determine whether a person is or is not a fit subject for the interdiction, it is necessary to bear in mind that it is not enough to show there is *delusion*, as in the lighter cases of monomania, but we are bound to ascertain how far the delusion affects the judgment of the person, so as to prevent him, like other men, from managing his affairs with provident care and propriety. In many instances, however, some proof of *delusion* only is sought for: and if this be procured, it is somewhat hastily inferred that the party must be entirely incompetent to the management of his property. The most difficult cases are those involving questions of imbecility. In conducting the examination of an alleged lunatic, we should compare his mind as it is with what it has been: and if it be a case of supposed imbecility, a proper regard must be had to age, society, education, and general conduct. We should also consider whether the person has been treated by his friends and relations as a lunatic or imbecile prior to the issuing of the commission. A young person whose education has been much neglected, and who has never been entrusted with the care of money, cannot be expected to have much knowledge of the method of managing a large property. Questions are sometimes put on the moral responsibility of man and the attributes of God to one who, perhaps, never heard of metaphysics. Arithmetical questions are asked which would embarrass many persons who are set down as sane and competent. In a case which occurred a few years since, one examiner asked the alleged imbecile, who said he had £1200 in the Bank, and received £20 for interest,—How much was that per cent? He said "he could not tell: he was no good hand at arithmetic." The counsel who appeared against the brieve or commission afterwards put the same arithmetical question to one of the medical witnesses who had deposed to the imbecility of the party; and this witness, an educated man, confessed himself unable to answer it—a practical illustration of the impropriety of pronouncing a person to be imbecile merely because he is ignorant of that which he has never been taught! (Case of *David Yoolow.*) If the capacity to manage affairs rested solely upon a knowledge of arithmetic, many now go free who ought to be immediately placed under interdiction. This is rather a commercial test of insanity: but it will be found that it has been applied in a very improper manner to determine the capacity of young and ill-educated females. Unless the questions be confined to those subjects which the party has had either the opportunity or inclination to learn, a medical witness will always incur the risk of confounding mere ignorance with imbecility. Perhaps one of the best tests of mental capacity will be found in determining the degree to which, with ordinary opportunities, the person has shown himself capable of being instructed. Too high a standard must not be assumed as a test of capacity. The mind of an alleged imbecile should not be compared with the most perfect mind, but with that of another person of average capacity, of the same age and station in society, and who has enjoyed like opportunities of instruction. A defective *memory* must not be hastily set down as a proof of legal unsoundness. In a case which came before the Lords Justices Bruce and Turner in August 1855 (*Re Toplis*), the petitioners for a commission appeared to have relied chiefly on a defect of memory in a person who was advanced in life. The Lords Justices, in dismissing the petition with costs, made the following observations: "Mr. Toplis's powers of recollection were impaired and defective, but this at advanced periods of life, and also at periods not advanced, was a common defect. A man might have a bad memory, but be a competent and efficient man, and no man would venture to suggest that a person could not discharge the business of life because he had a bad memory. The memory, indeed, might be so deficient as to bring a man within the technical description of unsound mind, but it could not be suggested that that was the case with Mr. Toplis. He appeared to recollect the events of his early life with readiness and freshness, and the more recent the event was, the sooner it faded from his memory; but, bad as his memory might be, he had more than sufficient mind within the ordinary meaning of the term to enable him to manage himself and his affairs. Dr. Southey, who had been deputed by their Lordships to examine Mr. Toplis, made use of the following expressions in his report. "With a memory so deficient, it can hardly be said Mr. Toplis is of perfectly sound mind." In one sense this might be true, but, as their lordships observed, there was a technical meaning of these words, in reference to which they dissented from their use. A man may not have a perfectly sound mind, and yet have a mind sound enough for the management of his affairs. A defective memory in an aged person, taken alone, proves nothing. (See Ann. d'Hyg. 1836, vol. 1. p. 192.)

A medical witness must not allow himself to be embarrassed by medical or legal definitions of insanity. The malady may not have the form of lunacy or idiocy in a strictly legal view; nor of mania, monomania, dementia, or idiocy, in a strictly medical view; but still it may be a case of *such mental disorder* as to create *an incapacity for managing affairs.* This is the point to which a medical examiner has to direct his attention. Cases of imbecility present the greatest difficulty, and create the greatest conflict among medical opinions. Imbecility strictly implies a weak or feeble mind, and the term is properly applied to one who has an intellect below par or below the normal average. The vagueness of these terms shows how difficult it is to draw a clear distinction between legal sanity and that degree of mental weakness implied by imbecility which would justify interdiction. Insanity in the common acceptation of the term cannot be proved in these cases: there will be no evidence of delusion, there may be such an amount of self-control as to enable a person to maintain a conversation. Memory, judgment, and other faculties, although weak, are still present in a greater or less degree; and, from one or two interviews only, an examiner might be disposed to pronounce the person of sound mind and competent to manage his own affairs. There is a wide field for argument here: for it may be said with some truth, in a defence, "that the doctors cannot put their finger on a single point indicative of insanity." In short, each fact specified by them may be frittered away by the remark that every one must have known some person who had either a bad memory, or a weak judgment; who squandered money, who wasted it on unworthy objects, who hoarded it and refused to pay just debts, or who lost it in foolish speculations, &c. All this may be true, and yet the person in question may be legally of unsound mind and properly interdicted. As Dr. Pagan justly remarks, there is a facility of disposition in an imbecile or weak-minded person, which lays him open to be imposed upon by the artful and designing: and our conclusion regarding his competency must be the result of a just appreciation of his general knowledge of affairs, and by an examination of *all* his faculties. We have to consider how far his imperfect faculties would prevent him from attending to his own interests, not in a manner which would insure their most profitable application, but in such a way as would prevent him from being involved in ruin. The test is, that his knowledge and understanding are so imperfect that his property would necessarily run to waste under his unassisted control. When it is proved that there has been habitual submission to the dictation of others, either from long habit of being controlled, indifference, or fear, this is itself a proof of weakness of mind, and a justification of the opinion that there should be interdiction. (Op. cit. 293.) On the other hand, if a person when left to himself has managed his affairs with reasonable care, and has acted independently of others, there can be no stronger proof of legal competency.

The testamentary capacity of imbeciles may be tried by the same rules. A man who is of such easy disposition as to be improperly influenced in the use of his property while living, may be equally influenced by fear or control to make an improper disposition of it in his will; but in this case the terms of the deed will allow a fair judgment to be formed of the mental soundness of the testator. Dr. Conolly has suggested one method of testing the state of mind, which it may be advisable to adopt, namely, to cause the individual to express his thoughts in writing. He would not here be led to suspect that he was being subjected to an examination for a hostile purpose. In many cases the evidence of a strong delusion existing in the mind has been derived from a will, deed, or letters written spontaneously by the lunatic or imbecile, when there was considerable difficulty in obtaining this proof by a verbal examination. Among many cases which illustrate the medical evidence required and received on commissions of lunacy, I would especially refer to that of *Miss Bagster*, in July 1832. (For the particulars of this case, which excited much interest at the time of its occurrence, see Med. Gaz. vol. 10. p. 519.)

Commissions may be superseded, but the evidence must then be as strongly in favour of sanity as it was before in favour of insanity In *Dyce Sombre's* case (July 1844), the physicians of England and France came to directly opposite conclusions, and English physicians were equally arrayed against each other! (See the judgment of the Lord-Chancellor, as reported in the Law Times, Sept. 28, 1844; also a notice of a treatise on his own case and the law of lunacy, by Mr. Dyce Sombre, in the Journ. of Psychol. Med. 1850, p. 409.) There have been few cases in which so great a difference of opinion has existed among medical witnesses as in this. Five English medical practitioners of good standing were, however, in favour of his sanity. The decision was against superseding the Commission, chiefly on the ground of the existence of delusion; but the most extraordinary part of the case was that the alleged lunatic was allowed to have the uncontrolled use of a large portion of his property! (Med. Gaz. vol. 40. p. 893.) In 1851, arrangements were made for an independent medical Commission, to inquire into the mental state of this gentleman, and, if possible, to reconcile the conflicting medical opinions already given; but before this was constituted, the alleged lunatic died. (For some remarks on this case, see a letter by Dr. Mayo, Med. Gaz. vol.

46. p. 123.; also Medical Testimony, p. 31.) It has been suggested by Dr. Chevers that many of the acts which were considered to indicate insanity in this case might be traced to Oriental habits and prejudices. (Med. Jur. for India, p. 574.)

Lucid intervals.—By a lucid interval we are to understand a temporary cessation of the insanity, or a perfect restoration to reason. This state differs entirely from a remission, in which there is a mere abatement of the symptoms. It has been said that a lucid interval is only a more perfect remission; and that although the lunatic may act rationally and talk coherently, yet his brain is in an excitable state: and he labours under a greater disposition to a fresh attack of insanity than one whose mind has never been affected. Of this there can be no doubt: but the same reasoning would tend to show that insanity is never cured; for the predisposition to an attack is undoubtedly greater in a recovered lunatic than in one who is and has always been perfectly sane. Even admitting the correctness of this reasoning, it cannot be denied that lunatics do occasionally recover for a longer or shorter period, to such a degree as to render them perfectly conscious of, and legally responsible for, their acts like other persons. The law intends no more than this by a lucid interval: it does not require proof that the cure is so complete that even a predisposition to the disease should be entirely extirpated. Such proof, if it could be procured, would be totally irrelevant. If a man acts rationally and talks coherently, we can have no better evidence of a restoration to reason. If no delusion affecting his conduct remain in his mind, we need not concern ourselves about the degree of latent predisposition to a fresh attack, which may still exist.

Lucid intervals sometimes appear suddenly in the insane. The person feels as if awakened from a dream, and there is often a perfect consciousness of the absurdity of the delusion under which he was previously labouring. The duration of the interval is uncertain; it may last for a few minutes only, or may be protracted for days, weeks, months, and even years. In a medico-legal view its alleged existence must always be looked upon with suspicion and doubt when the interval is short. These lucid intervals are most frequently seen in cases of mania and monomania: they occasionally exist in dementia, when this is not chronic, but has succeeded a fit of intermittent or periodical mania. They are never met with in cases of idiocy and imbecility. It is sometimes a matter of great importance to be able to show whether or not there exists, or has existed, a lucid interval: since, under these circumstances, the acts of a person are deemed valid in law. The mind should be tested, as in determining whether a patient is labouring under insanity or not. He should be able to describe his feelings, and talk of the subject of his delusion, without betraying any signs of unnecessary vehemence or excitement. It may happen that a person who is the subject of a commission of inquiry is, at the time of examination, under a lucid interval, in which case there may be some difficulty in forming an opinion of the existence of insanity. This occurred in the case of *Lady Seymour* (July 1838): when examined before a commission, her replies were so rational and collected that no verdict could be given, and the case was adjourned. When the inquiry was resumed, it was satisfactorily proved that she was insane, not merely by general and medical evidence, but by the terms of her will, which had been drawn up by herself. It has been said that a person in a lucid interval is held by law to be responsible for his acts, whether these be of a civil or criminal nature. In regard to criminal offences committed during a lucid interval, it is th opinion of some medical jurists that no person should be convicted under such circumstances; because there is a probability that he might at the time have been under the influence of that degree of cerebral irritation that renders a man insane. (Prichard.) This remark applies to those instances in which the lucid interval is short. Juries now seldom convict, however rationally in appearance a crime may have been perpetrated, when it is clearly proved that the accused was really insane within a short period of the time of its perpetration.

CHAPTER 69.

RESPONSIBILITY IN CIVIL CASES.—INSANITY AS AN IMPEDIMENT TO MARRIAGE—DEEDS AND CONTRACTS.—WILLS MADE BY THE INSANE—TESTAMENTARY CAPACITY—TEST OF CAPACITY—DELUSION IN THE DEED—ECCENTRICITY IN WILLS—WILLS IN SENILE DEMENTIA—WILLS IN EXTREMIS.—RESTRICTION IN MEDICAL OPINIONS.

RESPONSIBILITY IN CIVIL CASES.

Insanity as an impediment to marriage.—Insanity is deemed in law to be a civil impediment to marriage, because it is considered that there cannot be that rational consent which is necessary to the validity of a contract. The marriage of a lunatic is therefore called a nullity, and is void *ab initio.* All that the law requires is, that there should be good proof of insanity at or about the time of the contract. If this be offered, and it be alleged that the contract was entered into during a lucid interval, then the party who would benefit by the allegation must prove it. The suitableness of the marriage, as well as the conduct of the party during or after its performance, will also be considered by the Court. In *Turner* v. *Myers*, a lunatic who had recovered from his lunacy instituted a suit to set aside a marriage which he had contracted while in that state! The marriage was declared void. (Med Gaz. vol. 8. p. 481.) The case of *Baldry* v. *Ellis* (Norwich Summer Ass. 1851) will be found of interest in relation to the matrimonial engagements of alleged lunatics.

In *Read* v. *Legard* (Court of Exchequer, May 30, 1851), a question arose whether a lunatic was responsible for necessaries supplied to the wife. The articles supplied were for the sole use of the wife, the husband being a confirmed lunatic and the inmate of an asylum. The Court held that the fact of a husband being from the visitation of God unable to manage his affairs, did not absolve him from the obligation which he contracted when he married, to provide necessaries for the support of his wife. He was then of sane mind, and although he had subsequently become insane, that obligation was not revocable under the circumstances. (See also a report of the case of *Seaton* v. *Adcock*, Journ. Psychol. Med. 1851, p. 297.)

The validity of civil contracts entered into by lunatics, will depend mainly on the circumstances which accompany the act. If there be nothing unreasonable in the conduct of the lunatic, and the party with whom he contracts has no knowledge or suspicion of the insanity, then the contract will be binding on the lunatic and his representatives. It was so held in *Monckton* v. *Cameroux* (Exchequer, June 1848). This was an action by the administrator of a deceased person, to recover from the defendant, as secretary of an insurance office, the sum paid by him as the consideration for two annuities, the foundation of the action being, that at the time of the arrangement in question the deceased was not in a sound state of mind. At the trial before the Chief Baron it appeared that the negotiation had been conducted by the deceased with apparent prudence, sanity, and judgment, and that the arrangement entered into by him with the office was just such as any ordinary prudent person would have been expected to make with a view to his own interest. The deceased, who died very soon after the business had been arranged, was, both before and after, in an unsound state of mind. Under these circumstances, this action was brought by his representatives, and a verdict recovered by them, subject to the opinion of the Court on their right to recover as on the entire failure of consideration. The Chief Baron, in giving judgment in favour of the defendant, said it was sufficient for the purpose of this case to lay it down as a general rule, that when a person of apparently sound intellect enters into a contract such as any other ordinary person would enter into with others who act *bonâ fide*, and the parties cannot be restored to their former condition, it is no ground for setting aside the contract, that one of them was at the time *non compos mentis*. On appeal to the Exchequer Chamber this judgment was affirmed in May 1849. (See also the case of *Staniland* v. *Willett*, Vice-Chancellor's Court, Nov. 1848.) In the case of *Donat* v. *Haniquet* (Guildhall Sittings, 1854), on an action to recover a sum of money, in which the defence was that the defendant was of unsound mind at the time of the contract, Crompton, J., held that unless it was shown that the plaintiff had taken advantage of defendant's unsoundness of mind he would be entitled to recover the amount claimed.

Wills made by the insane. Testamentary capacity.—Questions involving the testamentary capacity of individuals are of very frequent occurrence, and medical evidence is commonly demanded. When property is bequeathed by the testator out of the usual order of succession, it may be alleged by the relatives that he was wholly incompetent to understand the nature of the deed—either from actual insanity, the imbecility of age, or that natural failing of the mind which is so often observed to occur on the approach of death. Bodily disease or incapacity does not affect the validity of a will, unless the mind be directly or indirectly disturbed by it. Some time since a case occurred in France, in which a will was contested on the ground that the testator, when he executed it, was labouring under hemiplegia. The opinion of Esquirol was demanded, and he said that hemiplegia might undoubtedly affect the brain, a fact clearly indicated by the sight, hearing, and other senses becoming weakened; yet this, in his opinion, did not necessarily indicate an impairment of the understanding. (Ann. d'Hyg. 1832, vol. 1. p. 203.) A man's mind, under these circumstances, may not be so strong as in robust health, but still it may retain a disposing power. In *Harwood* v. *Baker*, decided by the Privy Council in 1841, a will was pronounced to be invalid, owing to the general state of bodily disease in which the testator was at the time of making it. It appears that he was labouring under erysipelas and fever, and these diseases had produced a degree of drowsiness and stupor which rendered him incompetent to the act. In the case of *Day* (June 1838), epilepsy was alleged to have affected the mind; and in the case of *Blewitt* (March 1833), paralysis was adduced as a ground of incompetency. In all cases of this kind, the law looks exclusively to the actual *effect* of the bodily disease upon the *mind*; and this is commonly a purely medical question. In the case of *Penfold* v. *Crawford* (C. P. Dec. 1843), it was shown that the testator had lost his speech from an attack of apoplexy; but it was proved by medical evidence that his mental powers were good, and therefore a deed made subsequently to the attack was held to be valid. In the case of *Whyddon* v. *Billinghurst* (Prerog. Court, July 1850), a will was set aside because it was executed by the testatrix while labouring under an attack of cholera, in Sept. 1849, and proper means had not been taken to test the capacity of the deceased, who, at the time of its execution, was reduced to an extreme state of weakness. *Integritas mentis non corporis sanitas exigenda est.*

The case of the *Duchess of Manchester (the Duke of Manchester* v. *Bennett*, Kingston Lent Assizes, 1854) is of importance in relation to this branch of medical evidence. The Duchess had made a will, which was disputed on the ground that, from bodily illness and mental incapacity, she was not at the time competent to dispose of her property. In 1843 she had made a will bequeathing her property to her children. In 1848 she made another will revoking that of 1843, and bequeathing the absolute control of her property to her husband the Duke. This second will, which was executed on or about the 26th October 1848, was the subject of dispute. It appeared from the evidence that the Duchess had been seized with hysteria and strong convulsions on the 12th of September preceding, but her mind was not then affected. On the 1st October she was again attacked with convulsions, and, according to some of the witnesses, she laboured under acute mania, with symptoms of inflammation of the brain. She died on the 21st November, about three weeks after the execution of the will; and there was evidence to show that she had had some delusions both before and after its execution. A physician who was the medical attendant of the family, and who was one of the witnesses to the will, deposed that on the day it was signed, and for some days previously, the Duchess had recovered her reason, and that, at the time of signing it, she was, in his judgment, aware of what she was doing, and that she voluntarily delivered it as her own act and deed. It appeared also, that the disputed will was substantially such as the Duchess had announced her intention to make long before the execution of it, and when it was not suggested that she was in an unsound or incompetent state of mind. Three medical men of eminence were called on the part of the defendants; and they expressed their opinions, from the evidence, that the deceased, at the time of making the will, was incompetent to make it: that, in fact, she was proved to have been insane, and there was no medical evidence that she had had a lucid interval. These opinions were based on the nature of the illness, its duration, and the probability (for there was a want of any direct evidence on this point, except that which showed the Duchess to be in a sane and disposing state of mind) that this illness still affected her mind when she executed the will. The point at issue, then, was—

Was she, or was she not, in a competent state of mind at the time of executing the will? The jury found that she was competent, and that the will was valid; but a new trial was subsequently granted by the Vice-Chancellor, although the matter was ultimately arranged without it.

It is to be regretted that the rule given at p. 876 for testing the capacity of the testatrix was not adopted by the medical attendant before he attested the will of the Duchess. Had he applied this rule, there can be no doubt that the whole of the painful litigation which followed would have been avoided. Nevertheless, the evidence for the plaintiff, assuming the statements of the medical gentlemen who attended the Duchess to have been true, appears to me to show that, when the will was executed, the Duchess had a disposing capacity.

The great point at issue in the case was purely of a medical nature; namely, whether the delusions or wanderings under which the Duchess laboured during her illness were the rooted delusions of *insanity*—fixed mental derangement (mania), or only the temporary delusions of *delirium*—the result of the disease under which she was labouring. In granting a new trial, the Vice-Chancellor very properly stated, that, in reference to permanent proper insanity, there was great difficulty in proving a lucid interval. A patient so affected is not unfrequently rational to all outward appearance, without any real abatement of the malady; so that, in truth and substance, he is just as insane in his apparently rational, as in his visible raving, fits. But the apparently rational intervals of persons merely delirious are for the most part really such. Delirium is a fluctuating state of mind created by temporary excitement, in the absence of which, to be ascertained by the appearance and conduct of the patient, the patient is most commonly really sane. Further, in cases of permanent or fixed *insanity*, the burden of proof lay on the person setting up the instrument; and the presence or absence of delusions ought to be tested at the time by indisputable evidence that on the subject in question delusion is absent from the mind. If the delusions arose from *delirium*, the onus of proof would not be on the party setting up the instrument.

There probably never was a case in which the necessity of drawing a clear distinction between *mania* in its acute form, and *delirium* dependent on disease, was more strongly manifested than in this. The medical facts for the basis of an opinion were really few and simple, and they appear to me to lead to only one conclusion, *i. e.* that the occasional wanderings or delusions of the Duchess were the results of delirium from bodily disease, and not of permanent insanity,—that this state is quite compatible with the existence of intervals of perfect competency,—and that the conduct of the Duchess, at the time of executing the will, was such as to show that she had a full knowledge of the nature of the act which she was performing. I draw this conclusion from an examination of authentic notes of evidence given at the trial.

Test of capacity.—A person is considered to be of a sane and disposing mind who knows the nature of the act which he is performing, and is fully aware of its consequences. From some decisions that have been made, it would appear that a state of mind for which a party might be placed under interdiction would not render him incompetent to the making of a will. The validity of the will of a lunatic was once allowed, although made while he was actually confined in an asylum, because the act was rational, and it was such as the lunatic, some years prior to the attack of insanity, announced his intention of making. (*Coghlan's* case; see also, *Re Garden*, Law Times, July 6, 1844, p. 258; also the case of *Cartwright*, Mayo on Medical Testimony, p. 44.) In *Nichols and Freeman* v. *Binns* (Probate Court, Aug. 1858), the question was whether the will of a Mr. Parkinson made in a lunatic asylum near Norwich, was executed during a lucid interval. The jury found a verdict in favour of the will. The insanity of a party, when not already found insane under a commission, must not, in these cases, rest upon presumption, but be established by positive proof. The commission of suicide is often hastily assumed to be evidence of insanity; but it would not be allowed as a proof of this state, even when a testator destroyed himself shortly after the execution of his will. A case has been decided, where the testator committed suicide three days after having given instructions for his will; but the act was not admitted as a proof or even as a presumption of insanity, and the will was pronounced to be valid. A case has been decided on similar grounds in the French Courts. In *Edwards* v. *Edwards* (Prerog. Court, Feb. 1854), it was proved that the testator had committed suicide three days after the execution of his will, and there was some evidence of eccentric habits almost amounting to insanity; but the will was pronounced to be valid. As we shall see hereafter, suicide is not deemed in law to be a proof of the existence of insanity.

Delusion in the deed.—The validity of deeds executed by persons affected with monomania, is often a subject of dispute. The practice of the law here indicates that the mere existence of a delusion in the mind of a person does not necessarily vitiate a deed, unless the delusion form the groundwork of it, or unless the most decisive evidence be given that, at the time of executing the deed, the testator's mind was influenced by it. Strong evidence is often derivable from the act itself, especially when a testator has drawn it up of his own accord. In the case of *Barton* (July 1840), the Ecclesiastical Court was chiefly guided in its decision by the nature of the instrument. The testator, it appeared, laboured under the extraordinary delusion that he could dispose of his own property to himself, and make himself his own legatee and executor! This he had accordingly done. The instrument was pronounced to be invalid. But a will may be manifestly unjust to the surviving relatives of a testator, and it may display some of the extraordinary opinions of the individual, yet it will not necessarily be void, unless the testamentary dispositions clearly indicate that they have been formed under the influence of *a delusion*. Some injustice may possibly be done by the rigorous adoption of this principle, since delusion may certainly enter into a man's act, whether civil or criminal without our being always able to discover it; but, after all, it is perhaps the most equitable way of construing the last wishes of the dead. According to Sir John Nichol it is not necessary in civil suits to connect the morbid imagination with the act itself; if the mind is unsound the act is void. In *Roberts* v. *Kerslake* (Warwick Aut. Assizes, 1854) Lord Wensleydale held that to vitiate a will, if it be a case of delirium the act must be traced to delirious delusion: but if it be a case of lunacy it need not be traced to the delusion. In *Sharpe* v. *Macauley* (Winchester Aut. Ass. 1856) Martin, B., advised the jury in coming to a conclusion on the question at issue, whether the testator had a "sound and disposing mind," to look, not to the opinions of others, but to the man's own acts as well as his correspondence. A disposing mind implied that a man understood the nature of his property,—the use and benefits arising from it, and sense and discretion to select persons to enjoy his property after his death.

Eccentricity in wills.—The evidence in these cases sometimes amounts to proof of eccentricity only on the part of the testator, or in the deed itself; but a clear distinction must be here drawn. The will of an eccentric man is such as might always have been expected from him: the will of one labouring under insanity (delusion) is different from that which he would have made in an unaffected state;—the instrument is wholly different from what it would once have been. It has been justly observed, that the insane are eccentric in their ideas, their language, or their conduct; but the merely eccentric have but a voluntary resemblance to the insane. (Jamieson's Lectures, Med Gaz. vol. 46. p. 180.) In the case of a *Mr. Stott*, a medical electrician, whose will was disputed by his daughter on the ground of insanity, it was proved that the testator fancied he could deliver pregnant women by means of electricity, and he actually proposed to the wife of a baker living in the neighbourhood, to bring about her accouchement by an electrical machine! The will was pronounced invalid, not so much on account of this extreme absurdity, as of the violent and unnatural treatment to which he had subjected his daughter. It appeared that he had taken, as we now and then find in monomaniacs, a most unaccountable and causeless dislike to this girl from her earliest infancy. Strange as it may appear, electricity has been lately used as a means of aiding parturition, but under circumstances very different from those which gave rise to the absurd delusion in the case just related. (Med. Gaz. vol. 36. p. 376.) It has become a grave question, whether proof of *moral insanity; i. e.* a perverted state of the moral feelings or affections, independently of any direct evidence of *intellectual* disturbance, should be a sufficient ground to set aside the act of a testator. In the case of *Frere* v. *Peacocke* (Prerogative Court, Oct. 1845), this was the principal question at issue. The counsel who maintained the validity of the will argued against the admissibility of Pinel's doctrine of moral insanity, chiefly because there was a difference of opinion among those who adopted the doctrine, whether it was or was not invariably accompanied by some mental derangement. A doctrine thus novel, unsettled, and not sufficiently developed could not, it was urged, be safely applied to legal questions. If a man who was free from delusions (as the deceased in this case was), and capable of acts of business (as he was), might nevertheless be held to have been insane, it would involve this branch of testamentary law in utter confusion. A man who was not a subject for a commission of lunacy might be held after death to have been morally insane. The Court would have to deal with cases of kleptomania and pyromania, in which the individuals exhibited no trace of intellectual insanity or delusion of mind. It was safer to rely upon the ancient and general doctrine of these Courts, *that there was no insanity without delusion,—its true criterion*; and that in the present case the deceased, though eccentric, was not of unsound mind. The Court found that the will was valid, and that there was no proof of delusion. The deceased was a most unamiable being; but still his acts were not irrational, nor inconsistent with soundness of mind. (Prerog. Court, Aug. 1846.) In no case, probably, has eccentricity come so near to insanity as in this.

Wills are sometimes contested more on the ground of eccentricity, than of insane delusion; but, if eccentricity only be proved, a Court will not interfere. In the case of *Morgan* v. *Boys* (1838), it was proved that the testator, by his will, had left a large fortune to his housekeeper. The will was disputed on the ground that it bore intrinsic evidence of the deceased not having been in a sane state of mind at the time of making it. After having bequeathed his property to a stranger, the testator directed that his executors should "cause some parts of his bowels to be converted into fiddle-strings,—that others should be sublimed into smelling salts, and that the remainder of his body should be vitrified into lenses for optical purposes"! He further added, in a letter attached to his will,—"the world may think this to be done in a spirit of singularity or whim; but I have a mortal aversion to funeral pomp, and I wish my body to be converted into purposes useful to mankind." Sir H. Jenner, in giving judgment, held that insanity was not proved:—the facts merely amounted to *eccentricity*, and on this ground he pronounced for the validity of the will. It was proved that the deceased had conducted his affairs with great shrewdness and ability; that he not only did not labour under imbecility, but that he had been always treated during life as a person of indisputable capacity by those with whom he had to deal. The best rule to guide the Court, the judge remarked, was the conduct of parties towards the deceased; and the acts of his relatives evinced no distrust of his sanity or capacity while he was living. The deceased had always been noted for his eccentric habits, and he had actually consulted a physician upon the possibility of his body being devoted to chemical experiments after death. In the case of *Mudway* v. *Croft* (Prerog. Court, Aug. 1843), a will contested on the ground of insanity, but defended on the plea of eccentricity, Sir H. J. Fust said,—"It is the prolonged departure, without an adequate external cause, from the state of feeling and modes of thinking usual to the individual when in health, that is the true feature of disorder in the mind." See also the case of *Waring* v. *Waring* (Prerog. Court, Feb. 1847.) The case of *Yglesias* v. *Dyke* (Prerog. Court, May 1852) presents some singular points of interest, in reference to the distinction between eccentricity and insanity. The testatrix bequeathed by her will a considerable amount of property, which, as she was illegitimate, and as it was alleged incompetent to make a will, was claimed by the Crown. It was proved that she was of dirty habits, and among other facts that she kept fourteen dogs of both sexes, which were provided with kennels in her drawing-room! Two of the dogs slept in the same room, and one, which was blind, slept in the same bed with her! The testatrix also had a propensity for guinea-pigs, and was subject to some singular delusions. Some evidence was adduced to show that, in spite of these strange freaks, she was able to manage her own affairs; but the Court pronounced against the validity of the will, on the ground that the testatrix had for a long period laboured under insane delusions, and there was no proof that these had ceased. Her eccentricity was the result of insanity. Nothing is more common than to find this propensity for animals existing among females who live solitary or secluded lives. One old lady whom I knew, generally kept her sitting-room full of monkeys, to the great annoyance of her visitors. She was a woman of good family, and of a shrewd and strong mind, well able to look after her affairs and to dispose of her property. She was considered to be eccentric, but there was no trace of insanity about her. Other females are not happy unless surrounded by parrots, or unless their sitting-rooms are converted into aviaries for all kinds of birds. In *Mrs. Cumming's* case, it was alleged that this lady had a strong propensity for cats; these animals being provided with meals at regular hours, and furnished with plates and napkins. In this case a verdict of insanity was returned, not so much on account of the attention shown to the cats, as from her acts in reference to her property, and from her association with certain persons who appear to have taken advantage of her intellectual weakness. The fact is, this propensity for animals proves nothing in relation to the existence of insanity, unless there is good evidence of intellectual aberration. (See the case of *Dryden* v. *Fryer* Q. B. Dec. 1850, Journal of Psychol. Med. 1851, p. 285.)

Wills in senile dementia.—Wills made in incipient dementia arising from extreme age (senile imbecility) are sometimes disputed, either on the ground of mental deficiency, or from the testator, owing to weakness of mind, having been subjected to control and influence on the part of interested persons. If a medical man be present when a will is made, he may easily satisfy himself of the state of mind of a testator, by requiring him to repeat from memory the mode in which he has disposed of the bulk of his property. Medical men have sometimes placed themseves in a serious position by becoming witnesses to wills without first assuring themselves of the actual mental condition of the testator (case of the *Duchess of Manchester*, ante, p. 870). It would always be a good ground of justification, if, at the request of the witness, the testator had been made to repeat substantially the leading provisions of his will from memory. If a dying or sick person cannot do this without prompting or suggestion, there is reason to believe that he has not a sane and disposing mind. It has been observed on some occasions, when the mind has been weakened by disease, or infirmity from age, that it has suddenly cleared up before death, and the person has unexpectedly shown a disposing capacity. (Ann. d'Hyg. 1831, 360.) In *Durnell* v. *Corfield* (Prerog. Court, July 1844), where an old man of weakened capacity had made a will in favour of his medical attendant, Dr. Lushington held that there must be the clearest proof, not only of the *factum* of the instrument, but of the testator's knowledge of its contents. (Law Times, July 27, 1844.)

I am indebted to a learned judge for the following note:—"Another case may be noticed, which often occurs in the experience of lawyers, and to which, in attendance on aged persons, medical gentlemen do not sufficiently attend. A person's mind in extreme old age may be quite intelligent, his understanding of business clear, and his competency to converse upon and transact such undoubted, and his bodily strength good; but there may grow upon him such a fear and dread of relatives who may have surrounded him, and on whom he may have become perfectly dependent, that his nervous system is wholly overcome, and he becomes a mere child and tool in the hands of those about him, so that he has no power to exert his mind in opposition to their wishes, or to resist their importunities. His mind is enslaved by his fears and feeling of helplessness, so that to that extent, and in matters in which he may be moved by them, he really is facile and imbecile. This state of things seems, in great old-age, easily brought on, the faculties are otherwise entire and the bodily strength considerable. This state of a party's mind at a great age (93 or 94) was exhibited in a remarkable manner in a case from Scotland, which went to the House of Lords (*Cairns* v. *Mariënski*)."

Wills in extremis.—Wills made by persons whose capacity during life has never been doubted, while lying at the point of death, or, as it is termed, *in extremis*, are justly regarded with suspicion, and may be set aside, according to the medical circumstances proved. Many diseases, especially those which affect the brain or nervous system directly or indirectly, are likely to produce a dulness or confusion of intellect, under which a disposing power is lost. Delirium sometimes precedes death, in which case a will executed by a dying person would be at once pronounced invalid.

Restriction of medical opinions—In an important case (*Bainbrigge* v. *Bainbrigge*, Oxford Summer Ass. 1850), tried before Lord Campbell, in which the testamentary capacity of the testator was disputed, it was held that a medical witness, although conversant with cases of insanity, cannot be asked his opinion as to the insanity of a testator founded upon the evidence given at the trial in his hearing. (4 Cox, Criminal Cases, 454.) See on this subject Med. Gaz. vol. 46. p. 240.) In the case of the *Duchess of Manchester*, however (*ante*, p. 870), the opinions of Drs. Sutherland, Mayo, and Conolly, on the competency of the testatrix, were received by the Court, although based upon the evidence given at the trial.

CHAPTER 70.

THE PLEA OF INSANITY—CIRCUMSTANCES UNDER WHICH IT IS ADMISSIBLE. HOMICIDAL MONOMANIA—MORAL INSANITY—CAUSES—SYMPTOMS—DEGREES OF—LEGAL TESTS—MEDICAL TESTS—MOTIVE—CONFESSION—ACCOMPLICES—DELUSION—SUMMARY—TESTS OF IRRESPONSIBILITY—CASES IN ILLUSTRATION—SUMMARY OF MEDICAL EVIDENCE.

RESPONSIBILITY IN CRIMINAL CASES.

The plea of insanity.—This is a subject of considerable importance in a medico-legal view; for should a plea of insanity be improperly admitted in any criminal case, then punishment is made to fall unequally on offenders; and if, on the other hand, it be improperly rejected, punishment is administered with undue severity. The rule of law on this subject is, that no man is responsible like a sane person for any act committed by him while in a state of insanity. The plea may be raised for the smallest offence up to the highest crime—murder; but it is rarely raised in respect to smaller offences, because the close confinement to which an accused person, if found insane, would necessarily be subjected, would often be a heavier punishment than that which the law actually prescribes for the offence which he may have committed. In a case of felonious assault, it was urged by counsel in defence, that the prisoner was insane; but the evidence on this point was not by any means conclusive,—when it was intimated by the Court that, if this plea were admitted, the party would probably undergo a much longer imprisonment, than if on conviction he received the legal punishment for the offence! (See the case of the *Queen* v. *Reynolds*, Bodmin Aut. Ass. 1843.) The judge is reported to have said there was no proof of insanity. If the prisoner was pronounced insane, he might be imprisoned for life, and therefore he did not think *that* finding would benefit him! A verdict of guilty was returned, and the man was sentenced to eighteen months' imprisonment. The case shows at least that a defence of this kind may be sometimes indiscreetly put forward. Such a mode of dealing with the plea of insanity, *i. e.* of making it a question of expediency dependent on the amount of punishment for the offence, must be pronounced as unsafe and indefensible. Murder, incendiarism, and theft are the crimes for which the plea of insanity is commonly raised: and it has been generally confined in this country to those cases in which persons have been charged with murder or attempts at murder.

Murder may be perpetrated by one who is obviously labouring under delirium or violent mania, or by an idiot or imbecile. Apart from the circumstances connected with the criminal act there may be evidence of such a state of mind in the person as at once to exonerate him from that amount of responsibility which is exacted from one who is sane. The appearance of the accused, or the testimony of a medical man, renders it unnecessary to go into the evidence, and a verdict is returned accordingly. The cases of difficulty are those in which insanity presents itself in a doubtful aspect. Mania or imbecility may be pleaded, but it may be of so slight a nature as not legally to justify an acquittal for murder. The insanity must be proved to have existed at the time of the perpetration of the act. Whether the prisoner is or is not insane when placed on his trial is immaterial in reference to the question of responsibility. In the case of *Murray* tried before the High Court of Justiciary Edinburgh (Nov. 1858), it was proved that the accused recovered his sanity eight hours after he had killed the deceased; but he was acquitted on the ground of insanity at the time of committing the act.

In *Reg.* v. *Pate*, tried in 1850, at the Central Criminal Court, the prisoner was indicted for an assault on the Queen. It was proved that he had been guilty of strange and eccentric,—and even of that which some might call insane, conduct, but there was no evidence to show that he had not a reasonable control over his actions. Dr. Conolly admitted that the prisoner was labouring under no delusion, that he knew the distinction between a right and a wrong action, but was subject to sudden impulses of passion. He attributed his act to some sudden impulse which he was quite unable to control. Other witnesses deposed that in their opinion, although the prisoner was fully conscious of his act, he was *insane*. The late Baron Alderson, who tried the case, observed, in charging the jury, that it was not because a man was insane that he was unpunishable; and he must say that upon this point there was generally a very grievous delusion in the minds of medical men. "The only insanity which legally excused a man for his acts, was that species of delusion which conduced and drove him to commit the act alleged against him. They ought to have a proof of a formed disease of the mind, a disease existing before the act was committed, and which made the person accused incapable of knowing at the time he did the act that it was a wrong act for him to do." The jury convicted the prisoner, and he was sentenced to transportation. (Med. Gaz. vol. 46, p. 152; and Journ. Psychol. Med. 1850, p. 557.) The plea of insanity was here, it appears to me, advanced upon very weak grounds. Had the prisoner assaulted a policeman instead of the Queen, he would have been fined or imprisoned, and nothing heard of the plea, although the rank of the person assaulted can make no difference respecting the existence or non-existence of a diseased state of mind. (See some excellent remarks on this case by Dr. Forbes Winslow, Journ. Psychol. Med. 1859, 445.)

From the summing up of the learned judge in this case, it would appear that the existence of one degree of insanity admits of punishment for crime, while the existence of another degree excuses it. As it has been already remarked in speaking of testimonial capacity, nothing can be more absurd than to apply one general term "*insanity*" to the condition of all persons affected with mental disorder, and to pronounce them therefore all incompetent or all incapable, when common sense suggests that we are bound to inquire into the amount of capacity in each case. If all persons are to be excused from responsibility for crimes or offences, because they entertain certain delusions, or are guilty of eccentricity, it would be better at once to make one general rule, and render all their civil acts void, and at the same time give them the benefit of irresponsibility for any criminal acts, without inquiring into the *degree* in which insanity exists. Such a practice would hardly be compatible with the due exercise of justice, or with the safety of society. Admitting that in this case the accused was to a certain extent insane, there was a sufficient degree of sanity about him, as indicated by his general conduct, to justify conviction and punishment. If, however, according to the ruling of the learned judge, we are always to insist upon the proof of a disease of the mind existing *before* the act committed, it is clear that an act committed under a sudden access of insanity, by a person not previously labouring under delusions, would be punishable like that of a sane criminal. Dr. Wood, who has written on this subject, repudiates the doctrine that an insane person is necessarily irresponsible, and therefore unpunishable. "All who have had the opportunity of studying insanity know full well that, with comparatively few exceptions, insane persons are not only powerfully influenced, but materially controlled, by the same motives which influence and control those who are still mixing in the world, and who have never been suspected of mental derangement." (Plea of Insanity, 1851, p. 4.)

The great difference of opinion which exists between physicians and jurists in reference to this plea appears to me to consist in this:—Most jurists aver that no degree of insanity should exempt from punishment for crime, unless it has reached that point *that the individual is utterly unconscious of the difference between right and wrong at the time of* committing the alleged crime. Physicians, on the other hand, affirm that this is not a proper test of the existence of insanity: that those who are labouring under confirmed insanity, and who have been confined in asylums for years, are fully conscious of the difference between right and wrong, and are quite able to appreciate the consequences of their acts. Again, those who have patiently watched the insane for years, agree that the legal test of utter unconsciousness of right and wrong in the performance of acts would in reality apply only to persons who were suffering from delirium—from a furious paroxysm of mania, or from confirmed idiocy; and that if the rule suggested by Mr. Warren,—that a person, in order to be acquitted on the ground of insanity, should be proved to be as *unconscious* of his act *as a baby*,—were strictly carried out, there is scarcely an inmate of an asylum who happened to destroy a keeper or attendant, who might not be convicted and executed for murder. Such a rule amounts to a *reductio ad absurdum:* it would abolish all distinction between the sane and insane, between the responsible and the irresponsible, and it would consign to the same punishment the confirmed lunatic and the sane criminal. This species of *baby-unconsciousness of action* exists in idiots as well as in furious maniacs, but not in the majority of lunatics; and it may be safely asserted that, if this criterion be the true one, acquittals on the ground of insanity have involved a series of gross mistakes for the last fifty years. The only irresponsible lunatics, according to Mr. Warren, are precisely those who would not even have reason enough to plead to an indictment. Thus, while the medical profession is condemned for adopting opinions which would lead to the acquittal of criminals, the writer recommends a rule which would certainly lead to the execution of the greater number of confirmed lunatics charged with acts of homicide. The practical failure of such a rule is manifest, when it is found that persons who have destroyed life with a perfect consciousness of the wrongfulness of their acts are frequently acquitted. In the case of *Dadd*, who was acquitted on the ground of insanity, and who was proved to be a confirmed lunatic, it transpired that the man had actually provided himself with a passport and fled to France after destroying his father! (See Wood on the Plea of Insanity, p. 41.) It may be said that the consciousness of the insane is an insane consciousness, while the law implies the consciousness of a sound mind, but this involves a petitio principii. There have been numerous cases of acquittal, however, in which, until the act of homicide was committed, there was no imputation either against the sanity or the sane consciousness of the accused.

Having pointed out these inconsistencies, it is only proper to acknowledge that in theory the English law would punish a lunatic just as it would punish a sane man, provided the lunatic "had that degree of intellect which enabled him to know and distinguish between right and wrong; if he knew what would be the effects of his crime, and consciously committed it; and if with that consciousness he wilfully committed it." In practice, however, it is placed beyond doubt that some who ought upon these rules to be held responsible are acquitted on the legal fiction that they were at the time unconscious (or only insanely conscious) of the wrongfulness of their acts. Dr. Wood states that of thirty-three males confined as lunatics in Bethlem, who had actually committed murder, not including those where an unsuccessful attempt was made to perpetrate the same crime, *three* were reported sane; and he feels quite satisfied that two of these were *not insane* at the time they committed the murders: and of the fifteen males who had actually committed murder, five were reported sane, and two of them ought, in his judgment, never to have been acquitted on the ground of insanity. (Plea, p. 50.) These facts, then, are sufficient to show that the rule of law generally adopted in practice does not err on the side of severity. The only complaint that can be made is, that it operates with uncertainty. This question has been fully and ably examined by Dr. Bucknill. (Unsoundness of mind in relation to criminal acts, 1854, pp. 5. 16. 39.)

The attempt to establish this plea in cases of murder by poison has generally ended in failure, although there may even have been proof of hereditary insanity. (*Reg.* v. *Gallop*, Somerset Winter Ass. 1844; and *Reg.* v. *Allnutt*, C. C. C. Dec. 1847.) The crime of poisoning indicates malice and deliberation in a greater degree than it would be in general safe to admit as co-existing with a state of insanity. Alison, however, mentions one case of acquittal (*Sparrow*, 1829), in which this plea was admitted. The woman poured a large quantity of vitriolic acid down the throat of her own child. She then ran to a neighbour's house in a state of evident derangement, saying that she had killed the devil. Her insanity was clearly proved, and she was acquitted. (Crim. Law, p. 648.) When the defence of insanity is set up,—in order to warrant the jury in acquitting a prisoner on a charge of murder, it must be proved affirmatively that he is *insane in a certain legal sense*: if the fact be left in doubt, and if the crime charged in the indictment be proved, it is their duty to convict him. (*Reg.* v. *Stokes*, 3 Car. and Kir. p. 185.) It is proper that a medical witness should remember, in examining an accused party, who is alleged to have committed a crime while labouring under insanity, that the plea may be good, and yet the person be *sane* when examined. This was observed in the case of a lunatic, who killed his mother in February 1843. There was no doubt that he was insane at the time of the act; but two days afterwards he was found to be of perfectly sound mind. This sudden restoration to reason is sometimes met with in cases of homicidal mania. For a remarkable case of this description, where the motive of a man in killing his wife was apparently jealousy, see report by

MM. Leuret and Ollivier. (Ann. d'Hyg. 1843, vol. 2. p. 187; also 1836, vol. 2. p. 122.) Lord Hale mentions a case, in which a woman, soon after her delivery, killed her infant. She confessed the crime, was carried to prison, fell into a deep sleep, awakened quite sane, and wondered how she came there. (See also the case of *M'Callum*, Alison, p. 650.) It is customary to say that they who commit these heinous crimes while labouring under insanity are irresponsible. By this we are not to understand that they are allowed to go free. On the contrary, they are subjected to a close confinement, commonly perpetual, as it assuredly ought to be in all cases of murder: but depending on their recovery in respect to crimes of less magnitude. A power is vested in the executive only, to discharge recovered criminal lunatics, according to circumstances.

HOMICIDAL MONOMANIA.

Homicidal mania or monomania is commonly defined to be a state of partial insanity, accompanied by an *impulse* to the perpetration of murder. Persons who may not appear to labour under any *intellectual* aberration, are liable to be seized with a sudden impulse, under which they may destroy those to whom they are most fondly attached, or any person who may happen at the time to be involved in the subject of their delusion. Sometimes the impulse is long felt, but concealed and restrained: there may be merely signs of depression and melancholy about the person, and eccentric or wayward habits, but nothing to lead to a suspicion of the fearful contention which may be going on within the mind. Occasionally murder is perpetrated with great deliberation, and apparently under all the marks of sanity. These cases are rendered difficult by the fact that there may be no distinct proof of the existence, past or present, of any disorder of the mind; so that it would appear the chief evidence of the existence of insanity is in the *act* itself: of the existence of insanity, in the common or legal acceptation of the term, before and after the perpetration of the crime, there may be either no evidence whatever, or it may be so slight as not to amount to proof. Such cases are regarded and described by some medico-legal writers as instances of *insanity of the moral feelings* only, and this condition has been called "*Moral insanity*" (*ante*, page 840). Its existence as a state independent of a simultaneous disturbance of the reason or intellect, is denied by the great majority of lawyers; and there is no doubt that an unrestricted admission of the doctrine would go far to do away with all punishment for crime, for it would render it impossible to draw a line between (moral) insanity and moral depravity. "Moral insanity with a *sound mind*, it is contended, is a contradiction in principle; and whenever the mind is sound, it is further argued, a man's conscience and sense of right and wrong will always be sufficient to enable him to restrain evil desires and impulses." It appears to me that the great difference of opinion which exists on the subject between legal and medical authorities, turns rather upon the signification of words than upon any disagreement on the facts or the practical inferences to be drawn from them.

Causes.—The causes of homicidal monomania are assigned by Esquirol to cerebral irritation induced by bodily disease, excessive nervous excitement, vicious education, erroneous notions of religion,—to grief, destitution, and the power of imitation. With respect to the latter, it is a fact that the publicity given to horrible occurrences often excites a homicidal feeling. The sight of a weapon, or of the intended victim, also determines in an instant the perpetration of the act—the individual feeling himself drawn on by an irrational impulse which he can neither resist nor control. Disordered menstruation, arising from sympathy of the uterus with the brain, may likewise operate as a cause; and this it is the more important to observe, because the person affected may not have previously manifested any sign whatever of intellectual or moral insanity. (Case of *Brixey*, *post*, p. 894.) Esquirol alludes to the case of a female, who at every menstrual period experienced a strong desire to kill her husband and children, especially when she saw them lying asleep. Parturition is likewise a cause, and in this case the disorder may assume the form of what is called PUERPERAL MANIA. (See *post*, p. 907.) It is important for a medical jurist to bear in mind, that persons who are likely to be attacked by homicidal mania are not always characterized by a gloomy, melancholic, or irritable disposition; the disorder sometimes shows itself in those who have been remarkable for their kind and gentle demeanour and quiet habits. In these cases the murderous disposition may give no warning of its existence: this condition may, however, be sometimes indicated by a sudden change of character, corresponding to a sudden access of insanity.

Symptoms.—Homicidal mania, in its more common form, may make its appearance at all ages, even it is said, in children not more than eight or ten years old (?):—it is occasionally periodical, and the paroxysm of insanity is preceded by symptoms of general excitement. The patient experiences colicky pains, and a sense of heat in the abdomen or chest,—headache, restlessness,—the face is flushed or pale, the pulse hard and full, and the whole body is in a state of convulsive trembling. An act of violence is committed without warning, and the patient appears as if relieved from some oppressive feeling. He may be calm, and express neither regret, remorse, nor fear. He may coolly contemplate his victim, confess the deed, and at once surrender himself to justice. In some rare instances he may conceal himself, hide the weapon, and endeavour to do away with all traces of the crime. The symptoms just described have been observed to be more aggravated in proportion as the homicidal impulse was strong. The propensity to kill is sometimes a fixed idea, at others intermittent; and the patient can no more banish it from his thoughts than a person afflicted with insanity can divest himself of the delusive ideas which occupy his mind. (Esquirol, vol. 2. p. 105.) It has been supposed that Esquirol here implies a state in which there is no perversion of *intellect*. The facts which he mentions, however, clearly prove the contrary, for if a patient has not the power to banish from his thoughts this propensity to kill, he has passed beyond the bounds of reason, and is really insane. The admission of this fact proves that his mind must be unsound. Esquirol observes,—before the perpetration of the act there may be no sign of irrational conversation or conduct: but he asks the question—Because there is no proof of irrationality, are we to assume that these persons possess reason? Is it possible to reconcile the existence of a rational state of mind with the murder of those who are most dear to them? (Op. cit. vol. 2. p. 102.) In Esquirol's view, therefore, it may be taken that mere perversion (insanity) of *feelings*, irrespective of some latent aberration of *intellect*, does not exist, and moral insanity is therefore a conventional term for a state in which the proofs of mental disturbance are not so clear as in the generality of cases.

An erroneous notion prevails in the public mind, that a homicidal lunatic is easily to be distinguished from a sane criminal by some *certain* and invariable symptoms or characters, which it is the duty of a medical witness to display in evidence, and of a medico-legal writer to describe, But a perusal of the evidence given at a few trials will surely satisfy those who hold this opinion, that each case must stand by itself. It is easy to classify homicidal lunatics, and say that in one instance the murderous act was committed from a motive; *i. e.* revenge or jealousy;—in a second, from no motive, but from irresistible impulse; in a third, from illusion or delusive motive; *i. e.* mental delusion:—in a fourth, from perverted moral feeling, without any sign of intellectual aberration. This classification probably comprises all the varieties of homicidal insanity, but it does not help us to ascertain, *in a doubtful case*, whether the act was or was not committed under any of these psychological conditions. It enables us to classify those who are *acquitted* on the ground of insanity, but it entirely fails in giving us the power to distinguish a sane from an insane criminal, or a responsible from an irresponsible lunatic. According to M. Esquirol, whose views, more or less modified, are adopted by all writers on the medical jurisprudence of insanity, the facts hitherto observed indicate *three degrees* of homicidal mania:—

1. In the first the propensity to kill is connected with absurd motives or *actual delusion*. The individual would be at once pronounced insane by everybody. Cases of this description are not uncommon, and they create no difficulty whatever. The accused are rarely required even to plead to the charge.

2. In the second class, the desire to kill is connected with *no known motive*. It is difficult to suppose that the person could have had any real or imaginary motive for the deed. He appears to have been led on by a blind impulse.

3. In the third class, the impulse to kill is *sudden*, instantaneous, unreflecting, and *uncontrollable* (*plus forte que la volonté*). The act of homicide is perpetrated without interest, without motive, and often on persons who are most fondly loved by the perpetrator. (Maladies Mentales, vol. 2. p. 834.)

These three forms differ from each other only in degree;—the two first being strongly analogous to, but lighter modifications of, the third. All the cases which came before M. Esquirol had these features in common:—an irritable constitution, great excitability—singularity or eccentricity of character: and previously to the manifestation of the homicidal feeling there was a gentle, kind, and affectionate disposition. As in other forms of insanity, there was some well-marked *change of character* in the mode of life; and this may be taken as a proof that there must have been some degree of intellectual disturbance. The period at which the disorder commenced and terminated could be easily defined, and the malady could be almost always referred to some moral or physical cause. In two cases it was traced to the change produced by puberty, and in four to the power of imitation. Attempts at suicide preceded or followed the attack: all wished to die, and some desired to be put to death like criminals. In none of the cases was there any motive for the act of homicide. M. Esquirol believes that there are well-marked distinctions between this state and that of the sane criminal. Among these he enumerates: 1st, the want of accomplices in homicidal mania. 2nd, the criminal has *always* a motive—the act of murder is only a means for gratifying some other more or less criminal passion, and is almost always accompanied by some other wrongful act; the contrary exists in homicidal mania. 3rd, the victims of the criminal are those who oppose his desires or his wishes; the victims of the monomaniac are among those who are either indifferent, or who are the most dear to him. 4th, the criminal endeavours to conceal, and if taken, denies the crime; if he confesses it, it is only with some reservation, and when circumstances are too strong against him; but he commonly denies it to the last moment: it is the reverse with the monomaniac. The exceptions to which these characters are open will be considered hereafter. They have, undoubtedly, greater value in their combined than in their individual application, and when in any case they coexist, there is strong reason to believe that the accused party is irresponsible. The great difficulty in these cases, however, is to distinguish *moral depravity from insanity.* I agree with a medico-legal writer on this subject, that "no hideousness of depravity can amount to proof of insanity, unsupported by some evidence of a judgment incapacitated, or of a will fettered by disease. In those cases of mental disorder in which the emotions are perverted, and where there is no clear proof of *deranged intellect,*—cases which do from time to time occur,—the presumption of insanity in regard to a criminal action has to be upheld by evidence of a suspension of the will." (Jamieson's Lectures on the Med. Jur. of Insanity, Med. Gaz. vol. 48, p. 181.) But it is not possible in many cases to produce satisfactory evidence of the suspension of the will: this suspension can only be *assumed* from the act,—a dangerous assumption, and one that might lead to the confusion of crime with insanity.

Legal tests.—Admitting the existence of a state of homicidal mania as thus defined by Esquirol, it will become a question, how, when pleaded for one charged with murder, it is to be distinguished from a case in which the crime has been perpetrated by a really sane person. Tests, both medical and legal, have been proposed. The *legal test* was explicitly stated in the following terms by the whole of the judges in conference, in answer to queries put by the House of Lords in reference to the case of *M'Naughten,* who was tried and acquitted on the ground of insanity (June 19th, 1843).

Notwithstanding a party commits a wrong act while labouring under the idea that he was redressing a supposed grievance or injury, or under the impression of obtaining some public or private benefit, he is liable to punishment. The jury ought in all cases to be told that every man should be considered of sane mind until the contrary was clearly proved in evidence; that before a plea of insanity should be allowed, undoubted evidence ought to be adduced that the accused was of *diseased mind,* and that at the time he committed the act *he was not conscious of right or wrong.* Every person was supposed to know what the law was, and therefore nothing could justify a wrong act, except it was clearly proved that the party did not know right from wrong. If that was not satisfactorily proved, the accused was liable to punishment. If the *delusion* under which a person laboured were only *partial,* the party accused was equally liable with a person of sane mind. If the accused killed another in self-defence, he would be entitled to an acquittal; but if the crime were committed for any supposed injury, he would then be liable to the punishment awarded by the laws to his crime. (B. and F. M. R. July 1843, p. 273.)

It would appear from this, that the law, in order to render a man responsible for a crime, looks for a *consciousness of right and wrong, and a knowledge of the consequences of the act.* Thus, the complete possession of reason is not essential to constitute the legal responsibility of an offender; and it is also to be inferred from the results of several cases, that a man may be civilly incompetent, but sufficiently sane to be made criminally responsible. The proofs required in the two cases are essentially distinct. It has been objected to this *legal test*, that it is insufficient for the purpose intended: it cannot, in a large majority of cases, enable us to distinguish the insane homicide from the sane criminal. Many *insane persons* have committed acts which they knew to be wrong, and of the criminality of which they were at the time perfectly conscious. They have been known to murder others, in order to receive the punishment of death at the hands of the law; and therefore they must have been conscious of the wrongfulness, or rather of the illegality, of the act which they were perpetrating, and have known that they were committing an offence against the law of man. In short, the criminal nature of the act has often been the sole motive for its perpetration! (Ann. d'Hyg. 1852, vol. 1, p. 363.) It has been suggested with some truth, that it is rather the imperfect or defective appreciation of the motives to right or against wrong action, which leads to crime among the insane, and not the mere ignorance of right and wrong. Most lunatics have an abstract knowledge that right is right and wrong wrong; but in true insanity the voluntary power to control thought and actions, and to regulate conduct by this standard, is impaired, limited, or overruled by insane motives. A lunatic may have the power of *distinguishing* right from wrong, but he has not the power of *choosing* right from wrong. A criminal is punishable not merely because he has the power of distinguishing right from wrong, but because he voluntarily does the wrong, having the power to choose the right. (Jamieson's Lectures on Insanity, Med. Gaz. vol. 46, p. 827.) The case of *Hadfield*, who was tried for shooting at George III, and acquitted on the ground of insanity, furnishes an example of the existence of insane delusion, coupled with a knowledge of the consequences of the act which he was about to commit. He knew that in firing at the King he was doing what was contrary to law, and that the punishment of death was attached to the crime of assassination; but the motive for the crime was, that he might be put to death by others,—he would not take his own life. Again, *Martin*, the incendiary, admitted that he knew he was doing wrong according to the law of man, when he set fire to York Cathedral: he was conscious that the act was illegal, but he said he had the command of God to do it. Thus, then, we find that a full consciousness of the illegality or wrongfulness of an act may exist in a man's mind at the time of its perpetration, and yet, in spite of this, he may be legally acquitted on the ground of insanity. But it may be said, this is an insane or delusive consciousness, and part of the insanity under which he labours. Such an inference is not, however, justified by the facts.

Medical tests.—It will now be proper to examine the *tests* which have been proposed by medical jurists for detecting these cases of homicidal mania. 1. The acts of homicide have generally been preceded by other striking *peculiarities of conduct* in the individual,—often by a total change of character. 2. They have in many instances previously or subsequently attempted *suicide*: they have expressed a wish to die or to be executed as criminals. These supposed criteria have been repeatedly and very properly rejected, when tendered as medical proofs of insanity in Courts of Law. They are of too vague a nature, and apply as much to cases of moral depravity as of actual insanity; in short, if these were admitted as *proofs*, they would serve as a convenient shelter from punishment for many sane criminals.

3. *Motive for crime.*—The acts are without *motive*; they are in opposition to all human motives. A man known to have been tenderly attached to his wife and children, murders them,—a fond mother destroys her infant. It is hereby assumed or implied that sane men never commit a crime without an apparent motive; and that an insane person never has a motive, or one of a delusive nature only, in the perpetration of a criminal act. If these propositions were true, it would be easy to distinguish a sane from an insane criminal; but the rule wholly fails in practice. In the first place, the *non-discovery* is here taken as a proof of the *non-existence* of a motive; while it is undoubted that motives may exist for many atrocious criminal acts without our being able to discover them—a fact proved by the numerous recorded confessions of criminals before execution, in cases in which, until these confessions were made, no motive for the perpetration of the crime had appeared to the acutest minds. (*Reg.* v. *Hatto*, Bucks Lent Ass. 1854.) In the case of *Courvoisier*, who was convicted of the murder of Lord William Russell in June, 1840, it was the undue reliance upon this alleged criterion, before the secret proofs of guilt accidentally came out, that led many to believe he could not have committed the crime; and the "absence of motive" was urged by his counsel as the strongest proof of the man's innocence. It was ingeniously contended "that the most trifling action of human life had its spring from some motive or other." This is undoubtedly true, but it is not always in the power of a man untainted with crime to detect and unravel the motives which influence criminals in the perpetration of murder. No reasonable motive was ever discovered for the atrocious murders and mutilations perpetrated by *Greenacre* and *Good*; yet these persons were very properly made responsible for their crimes! It would be a fatal error to

infer insanity from what is termed the inadequacy of motive. In the inquiry whether a *particular* man committed the offence, this consideration may be of great weight,—of very little, however, when the inquiry is whether the man who did it is insane. On the trial of *Francis* for shooting at the Queen, the main ground for the defence was, that the prisoner had no motive for the act, and therefore was irresponsible; but he was convicted. It is difficult to comprehend under what circumstances any motive for such an act as this could exist: and therefore the admission of such a defence would have been like laying down a rule, that evidence of the perpetration of so heinous a crime should in all cases be taken *per se* as a proof of the existence of an irresponsible state of mind! Crimes have been sometimes committed without any apparent motive by sane individuals, who were at the time perfectly aware of the criminality of their conduct. No mark of insanity or delusion could be discovered about them, and they had nothing to say in their defence. They have, however, been properly held responsible. On the other hand, lunatics confined in a lunatic asylum have been known to be influenced by motives in the perpetration of crimes. Thus they have often murdered their keepers in revenge for ill-treatment which they have experienced at their hands. (See the case of the *Queen* v. *Farmer*, York Spring Assizes, 1837.) This man was acquitted as insane, while the clear motive for the homicide was revenge and ill-feeling. In another case the act of murder was perpetrated from jealousy. (*Reg.* v. *Goule*, Durham Summer Ass. 1845.) On the whole, the conclusion with respect to this assumed criterion is, that an absence of motive may, when there are other strong proofs of insanity, favour the view of irresponsibility for crime: but the non-discovery of a motive for a criminal act cannot of itself be taken as a proof of the existence of insanity or homicidal mania in the perpetrator. It is right to state, however, that the law invariably acts on the humane principle,—that the absence of a sufficient or reasonable motive is a presumption in favour of insanity. The acts of the insane are generally the results of motives based on delusion. In cases of idiocy an act of homicide has been committed merely as a result of imitation: and in imbecility,—from motives of an absurd and unreasonable kind. I am indebted to Dr. Sutherland for some of the particulars of the case of a young man, affected with imbecility, upon whom an inquisition was held in 1843. He was a person of childish manners, and among the symptoms of imbecility there showed itself a strong propensity for windmills. He particularly wished to be tied to one of the arms of the mill when they were going round. He would go any distance to see a windmill, and would sit watching one for days together. His friends removed him to a place where there were no mills, in the hope that this strange propensity would wear away. He collected a number of lucifer matches and set fire to the house where Dr. Sutherland attended him, with a view that he might escape during the confusion to the land of windmills; and on another occasion he enticed a child into a wood, and in attempting to murder it, cut and mangled its limbs with a knife in a horrible manner. How would any sane person have connected this propensity for windmills with the attempts at arson and murder? Yet it turned out that he had taken the resolution to commit these crimes in the hope that he should be removed to some place where there would be a mill! (See also Report on Lunatics, Quart. Rev. 1844.)

4. *Confession.*—The subsequent conduct of the individual:—he seeks no *escape*, delivers himself up to justice, and acknowledges the crime laid to his charge. This is commonly characteristic of homicidal mania; for by the sane criminal every attempt is generally made to conceal all traces of the crime, and he denies it to the last. A case occurred in September, 1843, which, however, shows the fallacy of this criterion. A man named *Dadd* murdered his father at Cobham, under circumstances strongly indicative of homicidal mania. He fled to France after the perpetration of the crime, and was subsequently tried and acquitted on the ground of insanity. (See also another case, Ann. d'Hyg. 1829, vol. 2. p. 392.) On the other hand, it must be remembered that sane persons who destroy the lives of others through revenge or anger, often perpetrate murder openly, and do not attempt to deny or conceal the crime; for they know that denial or attempt at concealment would be hopeless. Again, a morbid love of notoriety will often induce sane criminals to attempt assassination under circumstances where the attempt must necessarily be witnessed by hundreds, and there can be no possibility of escape. The attacks made some years since upon the life of the Queen are sufficient to bear out this statement.

5. *Accomplices.*—The sane murderer has generally *accomplices* in vice or crime; the homicidal monomaniac has not. Upon this it may be observed that some of the most atrocious murders committed in modern times, as those perpetrated by *Greenacre*, *Good*, *Courvoisier*, and others, were the acts of solitary individuals, who had neither accomplices nor any assignable inducements leading to the commission of the crimes. It is, however, a fact so far in favour of the existence of homicidal insanity, that the *insane* never have accomplices in the acts which they perpetrate. These criteria can hardly be described as medical; they are circumstances upon which a non-professional man may form just as safe a judgment as one who has made insanity a special study.

6. *Delusion in the act.*—The presence of *delusion* has been said to characterise an act of homicidal monomania, while pre-

meditation, precaution, and concealment, have been considered the essential features of the act of a sane criminal. With respect to delusion, it has been decided that the mere proof of the existence of this does not excuse the act; if the delusion be *partial*, the party accused is still responsible;—and if the crime were committed for an imaginary injury, he would be held equally responsible. (See *ante*, p. 887.) Much stress was formerly laid upon the *delusion being connected with the act* in cases of alleged insanity; but it must be remembered that, except by the confessions of insane persons during convalescence, it is not commonly easy for a *sane mind* to connect their most simple acts with the delusions under which they labour. Every act of homicide perpetrated by a really insane person is doubtless connected with some delusion with which he is affected; but it by no means follows that one who is sane should always be able to make out this connection; and it would be therefore unjust to rest the responsibility of the accused upon an accidental discovery of this kind. Let the following cases show how little a sane person is able to connect the delusions of the insane with their acts. Marc mentions that a patient of his was continually in the habit of licking the plaster from the walls of his cell.—in some places they had been licked quite bare by this disgusting practice. It was only accidentally discovered that the act was connected with a delusion, under which the man laboured, that he was licking and tasting the most delicious fruits! Another patient was in the habit of running up and down the ward, beating his own shadow with a stick. It turned out that he fancied this shadow to be an army of rats in constant pursuit of him! Lord Erskine's doctrine in *Hadfield's* case is, therefore, medically speaking, wholly untenable. The connection of a delusion with an act where it can be really traced, may serve to exculpate an accused party; but the non-establishment of this connection proves nothing.

It may be further observed that premeditation and precaution are met with in crimes committed both by sane and insane criminals; although these, with subsequent concealment, are certainly strong characteristics of sanity. It should be a question for a jury whether, when they are proved to have existed in any criminal act, there might not have been such a power of self-control in the person, although in some degree insane, as to justify the application of punishment. It is not the presence of a slight degree of mental aberration which necessarily indicates the loss of power of controlling actions. Are such individuals less beyond the influence of example than one half of the sane criminals who are punished?

Summary.—The foregoing considerations lead to the inference, that there are *no certain legal or medical tests* whereby homicidal mania can be proved to exist. Each case must be determined by the circumstances attending it: but the true test for irresponsibility in the ambiguous cases appears to be, whether the person, at the time of the commission of the crime, had or had not a *sufficient power of control to govern his actions.* This involves the consideration, not only whether insanity existed, but whether it had reached a degree to destroy (not consciousness of the act but) volition. If from circumstances it can be inferred that an accused person had this power, whether his case may fall within the above rules or not, he should be made responsible, and rendered liable to punishment. If, however, he was led to the perpetration of the act by an *insane* impulse, or, in other words, by an impulse which his mental condition did not allow him to control (lésion de volonté, Esquirol), he is entitled to an acquittal as an irresponsible agent. The power of controlling an act appears to me to imply the existence of such a state of sanity as to render the party responsible: and when there is this want of control, it may be fairly concluded that the person is irresponsible. (*Reg.* v. *Brixey*, C.C.C. May 1845, p. 894.) A test somewhat similar to this is constantly applied by juries, under the direction of our judges, to distinguish murder from manslaughter; and it is quite certain that sanity and homicidal mania are not more nicely blended, than are occasionally the shades of guilt whereby manslaughter passes into murder. The manner and circumstances under which a crime is committed will often allow a fair inference to be drawn as to how far a power of self-control existed or was exercised. A man in a violent fit of mania or delirium rushes with a drawn sword into an open street, and stabs the first person whom he meets;—another, worn out by poverty and destitution, destroys his wife and children to prevent them from starving, and then probably attempts to murder himself: these are cases in which there is fair ground to entertain a plea of irresponsibility; but when we find a man (*Reg.* v. *M'Naughten*) lurking for many days together in a particular locality, having about him a loaded weapon,—watching a particular individual who frequents that locality,—a man who does not face the individual and shoot him, but who coolly waits until he has an opportunity of discharging the weapon unobserved by his victim or others,—the circumstances appear to show such a perfect adaptation of means to ends, and such a power of controlling his actions, that one is quite at a loss to understand why a plea of irresponsibility should have been admitted. The acquittal was the more remarkable because there was no proof of general insanity, and the crime was committed for a supposed injury. According to the rules laid down by the fifteen judges (*ante*, p. 887). arising out of this case, the man should have been convicted.

Test of irresponsibility.—The test here proposed is more or less advocated by Esquirol, Marc, Ray, Pagan, Jamieson, and other writers on the medical jurisprudence of insanity. (Esquirol, Maladies Mentales, vol. 2. p. 842.) M. Marc adopts throughout the opinions of Esquirol. (De la Folie, vol. 2. p. 71.) Dr. Ray, an intelligent American writer, considers that all forms of homicidal monomania are characterized by an "*irresistible* motiveless impulse to destroy life" (Med. Jur. of Insanity, p. 268); and Dr. Pagan properly observes: "The very loss of the *control over our actions* which insanity implies, is that which renders the acts which are committed during its continuance undeserving of punishment." (Med. Jur. of Insanity, p. 211.) The test should be, according to Dr. Jamieson, "had the lunatic at the time of committing the deed a knowledge that it was criminal, and *such a control* over his actions, as ought, if exerted, to have hindered him from committing it?" (Med. Gaz. vol. 46. p. 827.) Was his mind so disordered that he had lost the power of control which is possessed by a person in a sane state? Thus, then, it would appear, from the concurrent views of medico-legal writers, and of experienced practical observers of the habits and conduct of the insane, that we have here a criterion whereby the responsibility or irresponsibility of an accused person ought to be tested; and although there will be some difficulty in determining how far an individual did or did not possess control over his act:—whether the impulse was or was not *insane* and irresistible (impuissance de la volonté): yet it must be borne in mind that the same objection applies with equal force not only to the present legal test (the existence or non-existence of a *sane consciousness of right or wrong* under which persons are yearly acquitted or executed), but to every test or rule, medical or legal, that has hitherto been proposed by physician or jurist. There is as great (if not greater) difficulty in distinguishing sane from insane consciousness of right and wrong, as in distinguishing a sane from an insane impulse in the perpetration of murder.

It is well known that persons seized with a desire to kill have been able, in some instances, to exercise a certain degree of control over their feelings, and have thus saved the lives of their intended victims, and themselves from the imputation of a heinous crime. Esquirol has recorded several instances of this kind. (Maladies Mentales, vol. 2. p. 807.) On other occasions the controlling power appears to be lost. The case of *Reg. v. Brixey* was tried at the Central Criminal Court, in June, 1845. The prisoner was a quiet, inoffensive girl, a maid-servant in a respectable family. She had laboured under disordered menstruation, and, a short time before the occurrence, had shown some violence of temper about trivial domestic matters. This was all the evidence of her alleged (intellectual) insanity,—if we except that which was furnished by the *act* of murder. She procured a knife from the kitchen on some trivial pretence, and while the nurse was out of the room cut the throat of her master's infant child. She then went down stairs and told her master what she had done. She was perfectly *conscious* of the crime she had committed; she appeared to treat the act as a crime, and showed much anxiety to know whether she should be hanged or transported. There was not the slightest evidence that, at the time of the act or any time previously, she had laboured under any delusion, or any intellectual aberration. The prisoner was acquitted on the ground of insanity, probably caused by obstructed menstruation. (Med. Gaz. vol. 36. pp. 166, 247.) In trying this case by the medical rules laid down for detecting homicidal monomania (*ante*, p. 889), we shall see that it falls under the 3rd, 4th, and 5th only; *i. e.* absence of motive,—no attempt to escape,—no accomplices. Admitting the probability of a connection existing between suppressed menstruation and insanity in the abstract, there was no proof of the existence of intellectual insanity in the case of this girl,—yet she was acquitted! The existence of insanity was a pure legal fiction based on the *act* committed, and on the *mode* in which it was committed. In the defence of *Brixey*, the late Mr. Clarkson uttered a plain medical and legal truth, in stating that "*no general rules can be applied to cases of this sort.* Each case must be decided by the peculiar facts which accompany it." Notwithstanding the precedent furnished by this case, and another of a similar kind, *Reg.* v. *Stowell* (Med. Gaz. vol. 47. p. 569), a Court of Law will no doubt commonly look for some clear and distinct proof of mental delusion or *intellectual* aberration existing previously to or at the time of the perpetration of the crime. If there be no proof of delusion, or of failure of intellect on the part of the accused, the plea of homicidal insanity from irresistible impulse may still be rejected. In *Reg.* v. *Burton* (Huntingdon Summer Assizes, 1848), the prisoner was indicted for the murder of his wife, by cutting her throat. It appeared that he had no motive for killing her, —that he had been previously unwell, and restless at night, —that he did not attempt to conceal or deny the commission of the crime. and that he expressed no sorrow or remorse for it when perpetrated. The medical witness attributed the act to a sudden homicidal impulse: the prisoner's reason was not affected, and he had not laboured under delusions. This appears to have been a proper view of the case. The learned judge dissented from the medical opinion, because the excuse of an irresistible impulse, co-existing with the full (?) possession of reason, would justify any crime whatever. It is highly probable that there was not a *full* possession of reason in this case. No reasonable being would commit an act of this nature under the circumstances mentioned. As in Greensmith's case, there may have been delusions springing up in the mind suddenly, and not revealed by the previous conduct or conversation of the accused.

There appears to have been no stronger reason for convicting this prisoner than for convicting Brixey. He was, nevertheless, found guilty, while Brixey was acquitted.

Among other cases there are those of *Reg.* v. *Frost*, Norwich Summer Ass. 1844; and *Reg.* v. *Dickenson*, C. C. C. March 1844. There are also the cases of *Nicholas Steinberg*, who cut the throats of his wife and four children, and then destroyed himself, in Sept. 1834; of *Lucas*, who destroyed his three children, in March 1842; of *Giles*, who cut the throats of two of his infant children at Hoxton, in Jan. 1843. In these instances, the unexpected act of murder was accompanied by suicide. In the case of *Mrs. Brough* (Guildford Summer Ass. 1854), it was proved that the accused destroyed six of her children by cutting their throats, and then attempted to destroy herself. She was acquitted on the ground of insanity, although there was no proof of mental derangement. These cases may be regarded as presenting fearful examples of that state which had been called homicidal mania, in which there were no previous symptoms of *intellectual aberration* amounting to *insanity* in the common meaning of the term, or of any irregularity of conduct on the part of the homicides to justify the least interference with their civil liberty. A uniform feature of these cases is, that the murderous act was directed against those who were most closely connected with the homicides in blood, and to whom they were attached by the tenderest ties.

It appears to me that such crimes as these cannot be fairly or reasonably regarded as the acts of *sane* and responsible persons; and even those who deny the existence of such a form of insanity as *homicidal monomania*, are in general compelled to admit that these dreadful motiveless murders are really the acts of insane and irresponsible agents. In reference to the case of *Brixey* (supra), if this woman was not labouring under moral insanity,—homicidal mania,—or an uncontrollable impulse to murder,—it is clear by the result that her mental condition at the time of perpetrating the murder was such as to justify her acquittal on the ground of insanity; and medical jurists do not ask for more than this, although the means by which they seek to obtain acquittals in such cases may appear objectionable and unsuited to legal dicta. To assert that there was an unconsciousness of the nature or criminality of the act in this case, would be conflicting with all the facts proved, and to contend that the consciousness of right and wrong, if it existed, was itself of an insane kind, would be a mere *ex post facto* assumption. The occasional existence of a state of homicidal mania appears to me to be fairly established by this case, for there was not the slightest evidence of previous *intellectual* aberration, or of insane conduct, if we except the act perpetrated and the mode of perpetrating it. The acquittal produced no shock to public feeling, like certain acquittals of a really doubtful kind. Had not the homicides in some of the instances above mentioned destroyed themselves, it is most probable that they would have been acquitted on the ground of insanity. In the case of *Staninought*, an acquittal actually took place: this man, who had attempted suicide, recovered, was tried, acquitted on the ground of insanity, and he afterwards destroyed himself.

Some doubt has existed whether a medical witness, on a trial in which a plea of insanity is raised, could be asked his opinion respecting the state of a prisoner's mind at the time of the commission of the alleged crime,—whether the accused was conscious at the time of doing the act that he was acting contrary to the law, or whether he was then labouring under any and what delusion. It has been decided by fourteen judges out of fifteen, that facts tending to lead to a strong suspicion of insanity must be proved and admitted, before the opinion of a medical witness can be received on these points. (See Med. Gaz. vol. 46. p. 240.)

In giving an opinion of the mental condition of a prisoner, it is no part of the province of a witness, to modify that opinion according to the *punishment* which may follow if the plea be rejected, but solely according to the medical *facts* of the case. The Legislature only is responsible for the punishment adjudged to crimes. Dr. Mayo has justly observed, that a medical witness is summoned to a Court of Justice in order to enable the judge and jury to arrive at certain practical conclusions. The question proposed to him involves a simple fact, and not its consequences, and if the latter consideration be entertained by him, it will be liable to bias his evidence on the fact, which is his legitimate topic. The definition of insanity becomes very expansive, when its expansion may become protective to a criminal with whom we may happen to sympathize. The question whether the accused is a responsible agent, is of a judicial nature: our evidence should be confined to the question whether the accused is *insane* in a certain sense or meaning in which it is understood and defined by the law. (Medical Testimony and Evidence in cases of Lunacy, 1854, p. 9.) A medical witness in these cases generally moulds his evidence to a foregone conclusion on the criminal responsibility of the accused, and he thus lays himself open to a remark from the judge, that he must not encroach on the functions of the jury. It is certainly a great evil, that under the present mode of laying this question before a jury, the law operates most unequally. One case becomes a subject of prominent public interest, and every exertion is made to construe the most trivial eccentricities of character into proofs of insanity: an acquittal follows. Another case tried at the Assizes may excite no interest,—it is left to itself,—the accused is convicted, and either executed or otherwise punished; although the evidence of insanity, had it been as carefully sought for and brought out, would have been as strong in this as in the former instance.

That this kind of defence has been carried too far, will be apparent from an observation of Mr. Baron Gurney, in the case of *Rex* v. *Reynolds*, where this learned judge said that "the defence of insanity had lately grown to a fearful height, and the security of the public required that it should be watched." So also Mr. Justice Coltman, in the case of *Reg.* v. *Weeman*, remarked, "that the defence of insanity was one which was to be watched with considerable strictness, because it was not any slight deviation from the conduct that a rational man would pursue under a given state of circumstances which would support such a line of defence. In more recent cases it has been resorted to simply because apparently every other defence was shut out by the evidence."

It cannot be denied that the doctrine of "irresistible impulse" has been strained in recent times to such a degree as to create a justifiable distrust of medical evidence on these occasions. It is obviously easy to convert this into a plea for the extenuation of all kinds of crime for which motives are not apparent, and thus medical witnesses often expose themselves to severe rebuke. They are certainly not justified in setting up such a defence, unless they are prepared to draw a clear and common-sense distinction between impulses which are "unresisted" and those which are irresistible. In the case of *Reg.* v. *Allnutt*, the prisoner, a boy aged 12, was convicted of poisoning his grandfather, under circumstances indicative of great contrivance and deliberation. The medical evidence entirely failed to show that the prisoner was or ever had been insane. The remarks made by the judge who tried the case (Rolfe, B.) are of some medico-legal importance. "The witnesses called for the defence had described the prisoner as acting from uncontrollable impulse, and they had made other statements, of the value of which it would be for the jury to decide; but he must say that it was his opinion that such evidence ought to be scanned by juries with very great jealousy and suspicion, because it might tend to the perfect justification of every crime that was committed. What was the meaning of not being able to resist an impulse? Every crime was committed under an impulse, and the object of the law was to compel persons to control these impulses. If it was made an excuse for a person who had committed a crime, that he had been goaded to it by some impulse, which medical men might choose to say *he* could *not* control, he must observe that such a doctrine would be fraught with very great danger to society."

Among cases deserving of notice are the following:—In *Reg.* v. *Adams* (Maidstone Summer Assizes, 1856), the prisoner was indicted for cutting and wounding her infant child, aged four months. It was proved that she was a quiet, harmless woman: there was no motive for the act, and when asked why she had done it, she said she had had an intention to do it for a fortnight, and that for three or four nights she had been unable to sleep in consequence of thinking about it: and at last she had done it. She was out of health at the time, and the medical evidence was to the effect that she was probably suffering from some morbid action of the brain when she committed the act. There was no evidence of *intellectual* insanity. Erle, J., considered that the prisoner was not criminally responsible on account of the state of her mind, and a verdict of Not Guilty was returned on the ground of insanity. The case of *Dedea Redanies* (Maidstone Winter Assizes, 1856) called forth this plea, apparently because there was no other point on which a defence could possibly turn. The prisoner inveigled two girls from their home under false pretences, and murdered them by stabbing them deliberately, one after the other, on the high road. He admitted that he had destroyed them, and no motive could be suggested but a morbid and unfounded feeling of jealousy. The acts and correspondence of this man before and subsequently to his conviction were such as to convey an idea that he was in some degree insane. Still there was no evidence that his insanity had reached a degree to justify his acquittal on this ground; and his conviction and punishment might fairly operate by preventing others, labouring under like morbid feelings, from indulging in a propensity to destroy life. The case of *Buranelli* (*Reg.* v. *Buranelli*, Cent. Crim. Court, April 1855), also a charge of deliberate assassination, created some difference of opinion in reference to this question. Dr. Conolly considered the prisoner's mind to be in an unsound state, while Drs. Mayo and Sutherland deposed that there was no unsoundness, and that the man was a hypochondriac rather than a lunatic. The crime was committed under circumstances which in my opinion fully warranted a conviction for murder. Absurdities of conduct or conversation are not of themselves sufficient to justify an acquittal on the ground of insanity. Even admitting that the acts adduced in evidence were not those of a person of reasonable mind, this, as it has been elsewhere stated, is not legally sufficient to justify an acquittal. The insanity must have reached such a degree as to overpower the mind or will, and when this is not proved, no case is made out for exculpation.

The theory of the law as laid down by the judges in M'Naughten's case is, that notwithstanding a person labours under delusions, if he commits an act which he knows to be contrary to law, he is liable to punishment (*ante*, page 887).

But as Dr Mayo observes, the very case which elicited this answer (*Reg.* v. *M'Naughten*), proves that the practice is not in accordance with the theory. "The adequacy of M'Naughten to comprehend the criminal nature of the homicidal act for which he was tried was unquestionable, yet he was acquitted on the plea of insanity, without the smallest reference to the conditions on which alone it is exculpatory, although they had been distinctly set forth as not complied with, in the opening speech of the Attorney-General. The prisoner was pronounced to be insane by several medical witnesses, and on this evidence the learned judge stopped the case, and directed an acquittal, without going into the question whether the prisoner was, or was not, ignorant of the illegal nature of the act. In his address to the jury, he used the ambiguous expressions of knowledge of "right and wrong"—not "legal and illegal," as absent in M'Naughten's mind. (Medical Testimony, p. 86.) The terms "right and wrong," thus used, are certainly vague and undefined. If that which is legal is right, and that which is illegal is wrong, it would be only proper to discard the words, "of a knowledge of right and wrong," and place the question before the jury in accordance with the answers given by the judges in M'Naughten's case—namely, whether the prisoner knew at the time of committing the act that it was illegal. But the verdicts in this and other instances prove that the law does not and cannot act rigorously upon this doctrine.

The following cases may be consulted with interest in reference to this subject. *Reg.* v. *Johnstone* (Med. Gaz. vol. 37. p. 421); *Reg.* v. *Ovenston* (Journal of Psychol. Med. 1848, p. 169); *Reg.* v. *Allnutt* (Journal Psychol. Med. 1848, p. 193): and *Reg.* v. *Brough*, Guildford Summer Assizes, 1854. (Journal Psychological Medicine, 1854, p. 609.) In the two first the prisoners were acquitted on the ground of insanity: although I quite agree with Dr. Mayo, in thinking that in Johnstone's case there was not the slightest proof of insanity. (Clinical Facts, p. 208.) The reader will find other cases in the Med. Gaz. vol. 42. p. 255; and *Reg.* v. *Clarke*, Norfolk Lent Assizes, 1851; *Reg.* v. *Monkhouse*, Cent. Crim. Court, Dec 1849; *Reg.* v. *Arnold*, Aylesbury Lent Assizes, 1850: and *Reg.* v. *Butler*, Shrewsbury Summer Assizes, 1853. In Mayo's Clinical Facts, 1847, p. 193; Croonian Lectures, Med. Times and Gaz. 1853; also Medical Testimony, 1854; in the Lettsomian Lectures of Dr. F. Winslow, Lancet, June 1853; Med. Gaz. vol. 37. p. 421, and Journal of Psychol. Med. 1848, p. 609: in essays on Unsoundness of Mind in reference to Responsibility, by Mr. Knaggs, 1854, by Dr. Bucknill on Unsoundness of Mind in relation to Criminal Acts, 1854, and by Mr. F. Stephen on the Criminal Responsibility of Madmen (Judicial Papers, vol. 1. p. 67).

The principles of the English law have been closely scrutinized by men who have had long experience in the management of the insane, and who have made themselves well acquainted with their habits; and it has been abundantly proved, that the test of responsibility assumed by it is of a purely theoretical kind, and cannot be carried into practice. With this admission it appears to me unnecessary to occupy space with metaphysical discussions regarding criminal responsibility; for however defective the rules, — if the *practice* of the law be in any one case in conformity with that which has been advised by writers on the medical jurisprudence of insanity, although it may be adverse to the theory on which it is professedly based, this is all with which we have to concern ourselves: — the principle is admitted. The great defect in the English law is, not that it will not go even to the full extent of exculpating a person who has committed a crime under what is called an "uncontrollable impulse," or an impulse which his reason was not sufficient to control, but the *uncertainty of its application.* The cases referred to show that an acquittal on the plea of insanity is on some occasions a mere matter of accident.

CHAPTER 71.

SUICIDAL MANIA — SUICIDE NOT NECESSARILY INDICATIVE OF INSANITY — SUICIDE A FELONY — IN RELATION TO LIFE-INSURANCE — HEREDITARY TAINT — PUERPERAL MANIA — PYROMANIA — KLEPTOMANIA — DRUNKENNESS — CIVIL AND CRIMINAL RESPONSIBILITY OF DRUNKARDS — ILLUSIONS — RESTRAINT — INTERDICTION — DELIRIUM TREMENS — SOMNAMBULISM — CIVIL AND CRIMINAL LIABILITIES OF THE DEAF AND DUMB.

SUICIDAL MANIA.

Suicide not necessarily indicative of insanity. — In monomania, especially in that form which is called melancholia or lypemania, there is often a strong propensity to the commission of suicide. This may proceed from sudden impulse or delusive reasoning. Suicidal mania is susceptible of being spread by imitation, especially when the mode of self-destruction adopted is accompanied by circumstances of a horrible kind, or by exciting great notoriety. The sight of a weapon or of a particular spot where a previous suicide has been committed, will often induce a person, who may hitherto have been unsuspected of any such disposition, at once to destroy himself. In some instances a person fancies that he is constantly watched or that he is oppressed and persecuted, and that his prospects in life are ruined, when, on the contrary, his affairs are known to be flourishing He destroys himself under this delusion. In cases of this description, whether arising from a momentary insane impulse or from delusive reasoning, there cannot be a doubt that the act is one of insanity. It is very different, however, when a real motive is obviously present,—as when an individual destroys himself to avoid disgrace or impending ruin, because here the results are clearly foreseen, and the suicide calculates that the loss of life would be a smaller evil to him than the loss of honour and fortune. It may be urged that a motive of this kind will appear insufficient to the minds of most men;—but what known motive is there sufficient to account for parricide, infanticide, or any other crime of the like horrible nature? It appears to me, we must allow either that all crime is the offspring of insanity, or that suicide is occasionally the deliberate act of a *sane* person. To say that suicide is always *per se* evidence of insanity, is to say substantially that there is no criminality in self-murder: for it is impossible to regard that act as a crime which is committed under a really insane delusion. (See Ann. d'Hyg. 1831, vol. 1. p. 225.) For some remarks on this subject, see Lectures by Dr. Jamieson, Med. Gaz. vol. 46. p. 523, and Journal Psychol. Med. 1850, p. 19.

The law of England very properly treats suicide as a felony; those who have attempted and failed in its perpetration are held to be sane and responsible agents, unless there should be clear evidence of their (intellectual) insanity from other circumstances: and it is certain, that the evidence required to establish this, must be much stronger than that sometimes admitted in cases of homicide.

Some singular medico-legal cases have occurred, involving the question—how far the act of attempting suicide is indicative of insanity. In the case of the *Queen* v. *Rumball* (Cent. Crim. Court, May, 1843), the prisoner was charged with attempting to drown her child. It appeared in evidence, that she fastened her child to her dress, and threw herself into a canal with the intention of destroying herself. She was rescued, and was subsequently tried and convicted of the felony of attempting to murder her child by drowning. Had she not been rescued, and had she succeeded in her purpose of self destruction, it is probable that the verdict of a jury would have been, as it so frequently is on these occasions,—"Temporary insanity." In *Reg.* v. *Furley* (Cent. Crim. Court, April 1844), the prisoner was convicted of murder under similar circumstances, but the sentence was subsequently commuted. In the case of *Reg.* v. *Gathercole*, 1839, a man was charged with the manslaughter of the deceased, under the following singular circumstances. The prisoner threw himself into a canal for the purpose of drowning himself: the deceased, who was passing, jumped in and rescued him: but by some accident he was himself drowned in the humane attempt. The defence was, that the prisoner was at the time insane, and therefore not responsible for the death of the person who attempted to save him; but this was negatived, and the prisoner was convicted. So if a man intending to shoot himself, fails, and by accident shoots a bystander, he will be held responsible, unless there be clear proof of insanity :—the act—the attempt itself, taken alone, will not be admitted as evidence.

Suicide in relation to life-insurance.—It is well known that according to the rules of some English Offices a policy of life-insurance is forfeited by the act of suicide; but supposing it to have been really an act of insanity, it has been doubted whether the policy would be legally forfeited. In an equitable view, the policy should not be forfeited under these circumstances, any more than if the party had died accidentally by his own hands. The condition truly implies that the party puts himself to death *deliberately*, and not unconsciously, while labouring under a fit of delirium or insanity. The question was raised in the case of *Borradaile* v. *Hunter* (Dec. 1841). This was an action brought to recover the amount of a policy of insurance effected on the life of a clergyman who threw himself into the Thames from Vauxhall Bridge, and was drowned The whole case turned upon the legal meaning of the words "*die by his own hand*," which formed the exception in the proviso to the payment of the policy. At the trial of the case, Erskine, J., directed the jury, that if the deceased threw himself into the river, knowing that he should destroy himself and intending to do so, the policy would be void :—they had further to consider whether the deceased was capable of distinguishing between right and wrong at the time, or, in other words, whether he had a sufficient knowledge of the consequences of the act to make him a felo-de-se. The jury found that the deceased threw himself into the water intending to destroy himself, and that previously to that time there was no evidence of insanity. They were then directed to take the *act itself*, with the previous conduct of the deceased, into consideration, and say whether they thought, at the time, he was capable of knowing right from wrong. They then found that he threw himself from the bridge with the intention of destroying himself, but that he was not then capable of judging between right and wrong. The jury were here evidently perplexed with the strict meaning of the words right and wrong :—the first part of the verdict made the case one of felo-de-se, the last part made it one of insanity. The verdict was entered for the defendants; *i. e.* that the deceased was a felo-de-se, and that the policy was therefore void. The case was subsequently argued before the four judges in the Common

Pleas (May 1843): it was contended for the plaintiff that according to the terms of the policy there must have been an *intention* by the party assured, to "die by his own hand;" and that an insane person could have no controllable intention. The judges differed:—three thought that there was no ground for saying that the deceased was affected by an uncontrollable impulse,—on the contrary, the jury had found that he threw himself into the river, knowing that he should destroy himself and intending to do so. In their opinion the act was one of felo-de-se, and the policy was void. Tindal, C. J., considered, that the verdict should be for the plaintiff, thereby leading to the inference that the act of suicide was in this case the result of insanity, and not of a felonious killing, to which alone he considered the exception in the proviso should apply. It is probable that if the term "*suicide*" had been inserted in the policy, instead of "*die by his own hand*," the decision would have been in favour of the plaintiffs; for to vitiate a policy from an accidental result depending on an attack of insanity, and *flowing directly from that attack*, is virtually vitiating it for the insanity itself! In this respect, it appears that the learned Chief Justice took a most sound and equitable view of this question, so important to the interests of those who have insured their lives. It is impossible for a man to enter into a contract *against an attack of insanity*, any more than against an attack of apoplexy! The jury found that the deceased was irresponsible for the act, and it is clear that the insurers and insured intended no more by using the terms "die by his own hand," than the act of suicide. By this decision, therefore, the insurers received the benefit of a wider interpretation of the terms than that which either party could have foreseen.

The question was again raised in the case of *Schwabe* v. *Clift*, Liverpool Summer Assizes, 1845. (Med. Gaz. vol. 36, p. 826.) The deceased, whose life was insured, destroyed himself by taking sulphuric acid. There was clear evidence of his being at the time in a state of insanity. The jury here, under the direction of Cresswell, J., took a proper view of the subject, and returned a verdict for the plaintiffs, thereby deciding that the policy was not vitiated by the mere act of *suicide*. The learned judge held that to bring the case within the terms of the exception, the party taking his own life must have been *an accountable moral agent, and able to distinguish right from wrong*. In this case, the term "suicide" was used in the policy, which the learned judge held to imply "a *felonious* killing." Supposing that the insured party was killed by voluntarily precipitating himself from a window while in a fit of delirium from fever, this would be an act of suicide or dying by his own hand; but it surely cannot be equitably contended that his heirs should lose the benefit of the insurance in consequence of an event depending on an accidental attack of a disease which no one could have foreseen, and against which no one could guard. If this principle be not admitted, the decision which must necessarily follow would appear to be against all equity; if it be admitted, then it must apply equally to every case of mental disorder, the proof of the existence of this resting with those who would benefit by the policy. On an appeal, the judgment in this case was, however, reversed, the judges again differing. It was argued for the insurers, that if a man retained just enough of *intelligence* to produce death by competent means, but was deprived of all *moral sense*, the policy was void. Against this view, it was urged by one of the judges, that whether the intellect was destroyed altogether, or only partially, it could make no difference. If death was the result of disease, whether by affecting the senses or by affecting the reason (thus leading to suicide), the Insurance office was liable under the policy. If the act was not the act of a sane and reasonable creature, it was not an act of suicide within the meaning of the proviso. Those judges who adopted the opposite view held that the meaning of the words, as introduced into the exception, was —if the party should kill himself *intentionally*. The words were considered to include all cases of voluntary self-destruction. If a party voluntarily killed himself, it was of no consequence whether he was sane or not. The majority of the Court held this view, and a new trial was granted. Had all the judges been present to give their opinions, the decision might have been different, for five had expressed themselves, at various times, in favour of the view that the term "suicide" in policies applies, as it ought to do, only to cases in which there is no evidence of insanity; while four had declared their opinion to be, that it includes all cases of "intentional" self-killing, whether the person be sane or insane. It is difficult to understand how a man in a fit of delirium or insanity can be said to kill himself voluntarily or intentionally. Will and intention imply the judgment of a sane man in regard to all civil and criminal acts; but a delirious or really insane person acts under a delusion, and as the law would hold him irresponsible in regard to others, his representatives should not suffer for an act which he was himself incapable of controlling. (See Law Times, July 18, 1846, p. 342.)

The decision in this case is of great importance to persons whose lives are insured; for it may be made to govern others; and on this principle, a man attacked with delirium, and who during the fit precipitated himself from a window, and was killed, would be declared a suicide within the meaning of the proviso, and a policy of insurance on his life would be *ipso facto* void. It will be perceived from this decision, that the law, as at present interpreted by the majority of the judges, is, that whenever a person destroys himself *intentionally*, whatever may be the state of his mind. the policy becomes void. It also appears that, according to this legal view of the question, a person may have and exercise this intention although undoubtedly *insane*. Whether he has been found so under a commission, or a verdict to this effect has been returned by a coroner's jury, is therefore unimportant. It must be proved by those who would benefit by the policy that the party died from his own act without *intending* to destroy himself. If a man take poison, or shoot himself, or commit any other act leading to his own death, it must be shown that it was the result of *accident*, and not of *design* on his own part. Some Insurance-offices now insert in the contract a proviso by which, whether the person be found *felo-de-se* or not, the policy shall be forfeited: but they reserve to themselves a power of returning a part or the whole value of the policy, calculated up to the day of death. In the meantime, they have the power of taking the full benefit arising from an act of suicide committed during a fit of delirium or insanity, in which, as medical men know, there can exist no controllable intention, no freedom of judgment, and no real exercise of will. (See case, Prov. Med. Jour. Aug. 9, 1848, 428.) There is a form of suicide not unlikely to present itself for consideration, namely, where a man, in the habit of taking a powerful drug for medicinal purposes, takes a large dose while in a state of intoxication and dies. In May, 1857, a *Mr. George Fife* died from an overdose of morphia, and it was proved, to the satisfaction of the jury, that this must have been taken while he was intoxicated. In such a case a man may have no sane intention of destroying himself, yet he dies by his own hands. As drunkenness does not excuse or justify any act of homicide, so it would not probably be allowed to affect the question of suicide; and death under such circumstances would probably be held to be a felonious killing.

From these cases one point is clear,—the act of suicide is not treated by the law as a necessary *proof of insanity*: and therefore the ingenious arguments which have been held on this subject have but little interest for a medical jurist in a practical view. It has been elsewhere stated, that acts of suicide have been mistaken for homicide, merely because the deceased had expressed no *intention* of destroying himself, and had manifested no disposition to the act by his previous conduct. This, however, is a fallacious view of the subject, since suicide from sudden impulse is by no means unfrequent: and even when the act bears about it marks of deliberation, it is not to be expected that a person should previously announce his intention, for this would be a sure way of defeating his object. Perhaps one of the most remarkable instances of suicide from sudden impulse, is the following, which is related by Sir

Charles Bell. Many years since, one of the surgeons of the Middlesex Hospital was in the habit of going every morning to be shaved by a barber in the neighbourhood, who was known as a steady, industrious man. One morning some conversation arose about an attempt at suicide which had recently occurred; and the surgeon remarked that the man had not cut his throat in the right place. The barber then casually inquired where the cut should have been made; and the surgeon pointed to the situation of the carotid artery. A few minutes afterwards, the surgeon was alarmed by hearing a noise at the back of the shop, and on rushing to the spot, found that the barber had cut his own throat with the razor with which he had been shaving him. The man speedily died!

If, as it is alleged, the act of suicide was in all cases the offspring of insanity, suicide should be frequent among the insane. Experience, however, is not in favour of this assumption. The report of the Commissioners of Lunacy for 1850, shows that there were then confined as lunatics 15,079 persons, while the suicides for the year among this large number amounted to only eight, of which six were perpetrated by strangulation. As mechanical restraint is either abolished or considerably diminished in most asylums, lunatics have now much more liberty than formerly, and yet suicides among them are comparatively rare. This favourable result must be in part ascribed to active superintendence and watching.

The tendency to suicide appears to be in some cases hereditary. Dr. Burrows relates an instance in which this propensity declared itself through three generations:—in the first, the grandfather hanged himself: he left four sons, one hanged himself, another cut his throat, and a third drowned himself in an extraordinary manner after having been some months insane: the fourth died a natural death, which, from his eccentricity and unequal mind, was scarcely to be expected. Two of these sons had large families: one child of the third son died insane two others drowned themselves, another became insane and made the most determined attempts on his life. Several of the progeny of this family, being the fourth generation, when they had arrived at puberty bore strong marks of the same fatal propensity.

In the opinion of Dr. Davey the suicidal propensity is in all cases and under all circumstances a positive sign or symptom of disordered mind (insanity). (Journal of Mental Science, April 1861, p. 110.)

PUERPERAL MANIA.

A homicidal propensity towards their offspring sometimes manifests itself in women soon after parturition. It seldom appears before the third day, often not for a fortnight, and in some instances not until several weeks after delivery. Out of ninety-two cases, Dr Simpson observed the attack to occur between the fifth and the fifteenth day in twenty-one. (Med. Times and Gaz. Sept. 1, 1860, p. 201.) The most frequent period is at or about the commencement of lactation, and between that and the cessation of the discharges (lochia). According to Esquirol, it is generally attended by a suppression of the lochia and milk. The late Dr. Ashwell remarked, that undue lactation may give rise to an attack of mania, under which the murder of the offspring may be also perpetrated. (Diseases of Women, p. 732.) See the case of *Reg.* v. *Lacey* (Nottingham Summer Assizes, 1858). It may also come on after forced or voluntary weaning. The *symptoms* do not differ from those of mania generally, but it may assume any of the other forms of insanity; and in one half of the cases it may be traced to hereditary tendency. According to Dr. Burrows, there is delirium, with a childish disposition for harmless mischief. The woman is gay and joyous, laughing, singing, loquacious, inclined to talk obscenely, and careless of everything around. She imagines that her food is poisoned: she may conceal the suspicion, and merely avoid taking what is offered to her. She can recognise persons and things, and can, though perhaps will not, answer direct questions. Occasionally there is great depression of spirits with melancholia. These facts are of some importance in reference to cases of alleged child-murder. This state may last a few hours, or for some days or weeks. The murder of the child is generally either the result of a sudden fit of delirium, or a sudden impulse, with a full knowledge of the wickedness and illegality of the act,—so that the legal test of responsibility of a knowledge of right and wrong cannot be applied to such cases, except on the assumption that insanity already exists, and taints the consciousness of the individual. Mothers have been known, before the perpetration of the murder, to request their attendants to remove the child. Such cases are commonly distinguished from deliberate infanticide by there being no attempt at concealment, nor any denial of the crime on detection. Several trials involving a question of puerperal mania have been decided, generally in favour of the insanity, within the last few years. Among these is that of *Reg.* v. *Ryder*, C. C. C. March 1856. There was an entire absence of motive in this as in most other cases of a similar kind. The mother was much attached to the child, and had been singing and playing with it on the morning of its death. She destroyed the child by placing it in a pan of water in her bedroom. The medical evidence proved that she had been delivered about a fortnight previously: that she had had an attack of fever, and that she had probably committed this act while in a state of delirium. She was acquitted on the ground of insanity, and Erle, J., remarked that it was evidently a case in which the insanity was only temporary, and the prisoner might be restored to her friends on a representation being made in the proper quarter. In most of these cases it will be found that the females are fully aware of the nature of the act, and that it is contrary to the laws of God and man: but they are unable to control their actions like sane persons.

Females in the *pregnant* state have been known to perpetrate murder apparently from some sudden perversion of their moral feelings: there has no doubt been latent intellectual disturbance, but not sufficient to attract the notice of friends. I am not aware that a plea of exculpation on the ground of insanity has been admitted in this country under these circumstances. (See case, Ann. d'Hyg. 1831, vol. 1. p. 374; see also, Ann. d'Hyg. 1859, vol. 2. p. 234.) For an able analysis of the present state of our knowledge on the subject of Puerperal Insanity, by Dr. Reid, see Jour. Psychol. Med. 1848, pp. 128, 284.

PYROMANIA.

Propensity to incendiarism.—This is described as a variety of monomania in which there is a morbid disposition of mind leading to acts of incendiarism without any motive. It is a condition not specially recognized by the law of England. We are informed by the advocates of its independent existence, that it proceeds from sudden impulse, or from delusive reasoning, but most commonly the latter. It has been chiefly remarked in females about the age of puberty, and is supposed to be connected with disordered menstruation. The case of *Jonathan Martin* has been frequently quoted as an instance of pyromania. He had, however, merely a delusion that he was deputed by God to burn down the cathedral of York, in order to do away with the heresies which he supposed to exist in the church. There was no doubt of his insanity: he had been already twice confined in an asylum. Nevertheless, as the late Baron Alderson (who was counsel for the prosecution) remarks, the act was perpetrated with much method. It seems that Martin remained behind after the afternoon service, and when left alone, he went up into the belfry, cut off about eighty or ninety feet in length of the *prayer-bell rope*, which, being usually rung from below, had been drawn up and coiled up to that length there. With this rope he knotted himself a sort of rope-ladder, and throwing it over the iron gates of the choir, he climbed over by means of the knots. Being in the choir, he struck a light with a flint and his razor, lighted a candle which he had brought, collected the prayer-books, and set fire to the paper, close to the carved work at the archbishop's throne, in two piles. He then cut away a silk curtain, gold fringe, &c., *which he stole*, and getting back by his rope-ladder into the body of the cathedral, he escaped through a window on the north side,—the most unfrequented part. He had provided himself with a pair of pincers, by which he forced the window, and let himself out by his rope-ladder to the ground. A sane criminal could hardly have devised a better method of perpetrating the act, or of escaping after its perpetration. The defence, as in most of these cases, was insanity at the time of perpetrating the act, and not specially Pyromania. This so-called mania is said to be not uncommon in young persons of both sexes, about the age of puberty. Assuming that a morbid impulse of the kind may exist, it should be cautiously received as an exculpatory plea, since otherwise it might be easily converted into a means for withdrawing real criminals from all legal control. I would here especially direct the attention of the reader to an essay on this subject by Professor Casper, of Berlin, in which he denies, with great probability, the existence of such a propensity as having any connection with insanity. He believes that incendiarism is always a criminal act, and unless there be clear evidence of a perverted mind, that it should be always punished as such. (Denkwürdigkeiten zur Med. Stat. Berlin, 1846, p. 255.) The plea has been admitted in English law (see cases. Med. Gaz. vol. 12. p. 80), but only in those instances in which there was strong reason to suspect the existence of intellectual aberration. In one case (*Reg.* v. *White*, Wilts Summer Ass. 1846), the prisoner was convicted on the principle that, although of weak intellect, she had reason enough to know right from wrong. (See Ann. d Hyg. 1833, vol. 2. p. 357; 1834, vol. 2. p. 94.)

Among several important trials in which a plea of insanity has been urged in defence in cases of arson, was that of *James Gibson*, tried before the High Court of Justiciary, Edinburgh (Dec. 23, 1844), and of which a full report will be found in vol. 4. of Brown's Reports of Cases before the High Court, 1845, p. 332. The prisoner was charged with setting fire to certain premises: and the defence chiefly rested upon the allegation, that he was in a state of mind which rendered him irresponsible for the act. Medical evidence was adduced in support of this proposition; but it failed to show that the insanity, if it existed, had reached such a degree as to render the accused irresponsible, and it did not appear that the circumstances on which the medical witnesses relied as proofs of insanity, had manifested themselves until *after* the perpetration of the crime with which he was charged. The prisoner was convicted, and sentenced to transportation for fourteen years. There was nothing in his case to justify a remission of the usual punishment assigned to this crime. Although this case is here noticed under the section of Pyromania, yet strictly speaking the defence turned rather upon the alleged existence of general insanity than upon that form of it in which the insanity is supposed to be attended with a propensity to incendiarism. The late Lord Justice Clerk Hope directed the jury to deal with the case according to the views laid down by the judges of England, and elsewhere quoted (*ante*, p. 887). He considered that the insanity to be proved as a ground of exemption must be total; *i. e.* "the disorder must amount to an absolute alienation of reason. * No such principle is recognized in law as that a man allowing a fancy or morbid feeling to get possession of his mind and temper, although it *disturbs* reason, while it does not *overthrow* it, will escape punishment, because, instead of resisting the temptations of such ill-regulated, morbid, distempered, and ungovernable feelings and prejudices (whether called delusions or not), he gives way to them and indulges in their gratification and satisfaction." These remarks, it will be seen, apply to the plea of insanity in general, and this learned judge further remarks, with respect to the knowledge of right and wrong: "A man must believe not that the crime is wrong in the abstract (for most madmen do admit murder to be wrong and punishable in the abstract), but that *the particular act*, committed under the influence of the motive which seems to have prompted it, was not an offence against the law. One may know that in the abstract the act is punishable, and yet believe that his particular act is not in law a crime and not punishable." From these extracts it will be perceived, that the law of Scotland, in reference to the plea of insanity in criminal cases is substantially the same as that of England. In *Reg* v. *Elderfield*, (Guildford Summer Ass. 1 44,) the prisoner was charged with arson, and Gurney, B., left it to the jury to say, not whether the prisoner had a weak or silly mind, but whether, at the time he committed the act, he was in such a state of mind as to know what he was about, and to be capable of distinguishing between right and wrong. The prisoner was acquitted on the ground of insanity. In another case (*Reg.* v. *Watts*, Norwich Winter Ass. 1844), the plea was negatived under the direction of the judge. On a more recent occasion (*Reg.* v. *Roberts*, Maidstone Winter Assizes, 1860), Baron Bramwell put the question of responsibility for arson in a still stronger light. Addressing the prisoner who had pleaded guilty he said—"That you are of unsound mind, I believe; but that is no reason why you should not be punished. I address the explanation of the reasons why I pass upon you the sentence which I am about to pronounce, not so much to your understanding as to those around who hear me, and to those whose duty it is to notice them. The law makes unsoundness of mind no excuse for offences, except it were such that you did not at the same time know the nature of what you were doing, and that it was wrong and unlawful. No doubt it is very unfortunate that persons of unsound mind should become by that affliction less under the influence of moral restraints and of the restraints of law; but it would be sad indeed for the public if, when those restraints are weakened, the protection of the law were to be withdrawn by the extension of impunity to offences. I am not sure that it is not more necessary to punish a madman than a sane one, so far as the protection of the public is concerned. I feel bound to sentence you to the same punishment as if you were sane."

KLEPTOMANIA.

Propensity for theft.—This term has been applied by Marc to that form of monomania which is said to manifest itself by a propensity to acts of theft. It is alleged by him and others that this propensity has often shown itself in females labouring under disordered menstruation, or among those who were far advanced in pregnancy, the motive being the mere wish of possession. Pregnancy, according to him, should be a good exculpatory plea, when a well-educated woman of strictly moral conduct, steals some unimportant article of no value compared with her worldly means and position in society. There are several instances on record showing that well-educated persons moving in a respectable sphere of society have been guilty of petty acts of theft. The articles taken have been valueless compared with their means. Instances of this kind have been brought before our Police-courts: and this motiveless impulse to theft has been occasionally pleaded: but in most of them the following facts have been clearly established by evidence:—1. A perfect consciousness of the act and of its illegality. 2. The article, though of trifling value, has still been of some use to the person,—thus these females have stolen articles either adapted to female use, or on which money could be raised. 3. There have been art and precaution in endeavouring to conceal the theft; and 4. either a denial of the act when detected, or some evasive excuse. When circumstances of this kind are proved, either the parties should be made responsible, or theft should be openly tolerated The evidence of a disordered state of the mind should not here be allowed to depend on the nature of the act, or every morally depraved person might bring forward a plea of insanity for any crime or offence. (See case, Ann. d'Hyg. 1838, p. 2. 435.) When the plea of insanity is raised in respect to other cases of theft, the rule appears to be, per Tindal, C. J., that there should be proof that the prisoner was incompetent to know that the particular act in question was a wrong one. (*Reg.* v. *Vaughan*, Monmouth Summer Ass. 1844.) In one instance, an acquittal took place apparently on the ground of insanity (kleptomania) from amenorrhœa (Carlisle Summ. Ass. 1845, *Reg.* v. *Shepherd.*) Cormack's Ed. J. Aug. 1845, p. 632.

DIPSOMANIA. DRUNKENNESS.

Civil responsibility of drunkards.—This state, which is called in law, frenzy, or "*dementia affectata*," is regarded as a temporary form of insanity. Jurists and legislators have differed widely respecting the degree to which drunkards should be made responsible for their acts. When the mind of a man is completely weakened by *habitual* drunkenness, then the law infers irresponsibility, unless it plainly appear that the person was at the time of the act, whether of a civil or of a criminal nature, endowed with full consciousness and reason to know its good or evil tendency. Any *deed* or *agreement* made by a party when drunk is not invalidated by our law, except in the case in which the intoxication has proceeded so far as to deprive him of all consciousness of what he is doing; and a Court of equity will not interfere in other cases, unless the drunkenness was the result of collusion by others for the purposes of fraud. When the drunkenness has occasioned a temporary loss of the reasoning powers, the party is incapable of giving a valid consent, and therefore cannot enter into a contract or agreement, for this implies *aggregatio mentium, i. e.* a mutual assent of the parties. Partial drunkenness, therefore, provided the person knew what he was about, does not vitiate a contract or agreement into which he may have entered. Thus the law appears to create two states in drunkenness:—one in which it has proceeded to but a slight extent, and it is considered that there is still a power of rational consent; another in which it has proceeded so far, that the person has no consciousness of the transaction, and therefore can give no rational consent. The proof of the existence of this last state would vitiate all the civil acts of a party. A confession made by a man while in a state of drunkenness, is legally admissible as evidence against him and others, provided it be corroborated by circumstances. In a case tried a few years since, the prisoner confessed, while drunk, that he had committed a robbery and murder which had taken place some time before, but of which he had not been suspected. He mentioned a spot where the property of the murdered person had been concealed by him, and the whole of the circumstances of the murder. The property was found as he had described it, and the case was clearly brought home to him, chiefly by collateral evidence from his own confession. He was convicted. In a case tried at the Central Criminal Court, in Oct. 1849, a man pleaded his drunkenness at the time of his first marriage, as a defence to a charge of bigamy. There was some evidence to show that he was drunk when the ceremony was performed. He was, however, convicted. (Med. Gaz. vol. 44. p. 762.)

Criminal responsibility of drunkards.—When *homicide* is committed by a man in a state of *drunkenness*, this is held to be no excuse for the crime. If voluntarily induced, whatever may be its degree, it is not admitted as a ground of irresponsibility, even although the party might not have contemplated the crime when sober. (*Reg.* v. *Reeves*, Derby Winter Assizes, 1844.) Thus it appears that when the state of drunkenness is such that any civil act of the person would be void, he may still be held legally responsible for a crime like murder. Some judges have admitted a plea of exculpation, when the crime has been committed in a state of frenzy arising from *habitual drunkenness*; but even this is not general. The question, whether the person was or was not drunk at the time of committing a crime, may be, however, occasionally of some importance. It was held by Patteson, J., that although drunkenness is no excuse for any crime whatever, yet it is of very great importance in cases in which there is a question of *intention*. A person may be so drunk as to be utterly unable to form any intention at all, and yet he may be guilty of very great violence. (*Reg.* v. *Cruse*, 8 C. & P. 546.) Again, when it is a question whether the accused was actuated by malice or not, the jury may under certain circumstances be required to take the fact of drunkenness into consideration, and this may have an influence upon their verdict. While, then, drunkenness does not furnish any excuse for a crime, it may become material with reference to the *intent* with which an act has been perpetrated. (Law Times, Sept. 27, 1845, p. 542.) It is obvious that if drunkenness were to be readily admitted as a plea of irresponsibility, three-fourths of the whole of the crimes in this country would go unpunished. In those cases in which the head has sustained any physical injury, as it often happens with soldiers and sailors, drunkenness, even when existing to a slight extent, produces sometimes a fit of temporary insanity, leaving the mind clear when the drunken fit is over The law makes no distinction between this state and ordinary drunkenness, although juries occasionally show by their verdicts that some difference ought to be made. (See cases in Alison, p. 653.)

Illusions.—Hallucinations and illusions are a common effect of drunkenness, and often lead to the commission of criminal acts. Marc relates a case, where two friends being intoxicated, the one killed the other under an illusion that he was an evil spirit. The drunkenness of the accused was held to have been voluntary: and he was condemned to ten years' imprisonment with hard labour. A case of this description was tried at the Norfolk Lent Assizes, 1840. (*Reg.* v. *Patteson.*) A man while intoxicated killed his friend, who was also intoxicated, under the illusion that he was some other person who had come to attack him. The judge made the guilt of the prisoner to rest upon whether, had he been sober, he would have perpetrated the act under a similar illusion! As he had voluntarily brought himself into a state of intoxication, this was no justification. He was found guilty of manslaughter, and sentenced to two months' imprisonment.

The proof of drunkenness may fail, but still, if the party charged with the death acted under an illusion, he will be acquitted. In *Reg.* v. *Price* (Maidstone Summer Ass. 1846), it was proved that prisoner who had been on friendly terms with deceased, was going home at night, having previously been in company with deceased at a public-house, when, according to his statement, a man sprang upon him from the hedge by the road-side, and demanded his money and his watch, or else he said he would have his life: the prisoner closed with and beat him severely, inflicting such injures that he died shortly afterwards. The supposed robber turned out to be the friend, and it was believed that he had made an attempt to rob the prisoner jokingly, which, however, had ended in this fatal manner. The prisoner throughout told the same story, and there did not appear to be the slightest ground for believing that it was untrue. Coltman, J., after hearing the evidence of the witnesses, said it appeared to be quite clear that the prisoner had acted under an impression that he was protecting his own life from the attack of a robber, and under such circumstances he could not be held to be criminally responsible. The jury accordingly returned a verdict of *not guilty*, and the prisoner was discharged.

Restraint.—Interdiction.—Drunkenness, even when habitual, is not a sufficient ground for the imposition of restraint or interdiction in the English law. Thus, on a commission in Nov. 1836 (*re Holden*), a jury returned that the party was of weak mind and given to habits of drunkenness, but that he was not of unsound mind. On application, the Lord Chancellor refused to interfere. This part of our law requires serious revision.

The case of *Mrs. Armstrong*, (Queen's Bench, February 1858,) presents some features of interest in reference to the alleged mental unsoundness of drunkards. The defendant, a lady, æt. 58, had been declared of unsound mind by a commission in August 1857. In September she escaped, and went to France: she returned to this country in January 1858, and endeavoured to set aside the verdict of unsoundness by these proceedings. It appeared that her father had bequeathed to her by his will, two thousand pounds per annum, to be paid to her monthly by trustees. The evidence at the trial showed that she was ill-educated—ignorant, and naturally of weak mind, amounting, according to some of the witnesses, to imbecility. For about ten years she had given way to habits of excessive drinking, and these habits, according to the evidence for the Crown, had still further weakened her intellect. She had been confined four times in lunatic asylums, and her unsoundness had been testified by Drs. Arnott, Conolly, Forbes Winslow, and others.

On the part of defendant, it was contended that her mind was sound, except when she gave way to drunkenness, and that by the cessation of this habit she would be perfectly sane and competent to manage herself and property. Further, that a mere drunkard could not, and ought not, to be deprived of his civil rights, unless it was proved that his mind had become permanently disturbed by his vicious habits, and this, it was urged, had not been proved of the defendant. Dr. Conolly, however, testified that although she was a year under his supervision, without any access to drink, her mind was still unsound. It appeared also that she had no control over herself in this respect: for when she escaped to France, it was proved that she still drank brandy to excess, and for a month was drunk almost daily.

Drs. Monro, Baly, Wood, and myself, saw this lady on several occasions previous to the trial, for the purpose of testing her state of mind. We found her weak-minded,—evasive,—untruthful, and although sober at the time of our visits, it was clear from her admissions, that she still drank wine and spirits in excess. She denied that she had ever been insane; and admitted that although she had hoarded £3200 in sixteen months, she had not paid her tradesman's bills, and had incurred a large debt at an hotel, for which an action had been brought against her husband. She refused to give any account of the disposal of her money, or to furnish any explanation in reference to the large sum accumulated.

Having heard at the trial the evidence respecting her unsoundness previous to the inquisition, and having remarked an entire absence of proof that this had been removed when she was left to her own control, Drs. Monro, Baly, and myself, came to the conclusion that from original weakness of intellect, aggravated by habits of drinking, she was of unsound mind, and incapable of taking care of herself or her property. Upon this declaration no witnesses were called for the defence: and the jury, who had had an interview with the lady, returned a verdict that she was of unsound mind, two, out of the twelve, stating that her mind was sound, but that she was incompetent to manage her affairs on account of her habitual drunkenness. These two jurors therefore considered that she was a dipsomaniac. If this view were correct, she ought to have been discharged, as such persons are not subject to restraint or interdiction by the English law There was no evidence to show that she had recovered, while there was evidence that abstinence from drink at a former period had not led to recovery. These dissentients must have based their opinion on their own personal judgment of her condition after a short interview.

An excessive indulgence in habits of drinking does not necessarily derange the mind: but it practically renders a person unfit for the government of himself and his property; and it is therefore a question whether it would not be for the benefit of such persons, and those dependent on them, if the law interferred and placed them under the same restraint as those whose minds had been actually rendered unsound by this pernicious habit.

DELIRIUM TREMENS.

This is a disordered state of mind which proceeds from an abuse of intoxicating liquors. Habitual drunkenness appears to be the predisposing, while abstinence from drink is the immediately exciting cause. Thus, the disorder frequently does not show itself until the accustomed stimulus has been withdrawn for a certain period. It commences with tremors of the hands, by which it is known from ordinary delirium, and restlessness; and the individual is subject to hallucinations and illusions, sometimes of a horrible kind, referring to past occupations or events. The patients are often violent, and prone to commit suicide or murder, more commonly the former; hence they require close superintendence. Persons labouring under this disorder are incompetent to the performance of any civil act, unless the mind should clear up before death. They are not responsible for criminal acts committed while they are labouring under an attack. Acquittals have even taken place on charges of murder, when there was deliberation as well as an apparent motive for the act. Thus, then, although this disorder may have been voluntarily brought on by habitual drunkenness, the law admits it as a sufficient plea for irresponsibility; while in a case of confirmed drunkenness, it rejects the plea. In delirium there is a formed disease of the brain, while voluntary drunkenness merely produces a temporary disturbance of its functions. A trial has taken place in which the evidence showed that the homicide had been committed by an individual while labouring under an attack of delirium tremens. (*Reg.* v. *Simpson*, Appleby Sum. Ass. 1845.) The prisoner's mind had become unsettled from this disorder brought on by habitual drunkenness. In another case the plea was also admitted without difficulty. (*Reg.* v. *Watson*, York Winter Ass. 1845.)

SOMNAMBULISM.

It has been a contested question among medical jurists, how far a person should be held responsible for a criminal act, perpetrated in that half-conscious state which exists when he is suddenly roused from sleep. There is no doubt that the mind is at this time subject to hallucinations and illusions which may be more persistent in some persons than in others; but it is difficult to suppose, unless we imagine that there is a sudden access of insanity, that an individual should not recover from the delusion, before he could perpetrate an act like murder. A remarkable case of this description, that of *Bernard Schedmaizig*, will be found in Marc (Op. cit. vol. 1. p. 56); and a trial involving this question occurred in England a few years since. A pedlar who was in the habit of walking about the country armed with a sword-stick, was awakened one evening, while lying asleep on the high road, by a man, who was accidentally passing, seizing and shaking him by the shoulders. The pedlar suddenly awoke, drew his sword, and stabbed the man, who soon afterwards died. He was tried for manslaughter. His irresponsibility was strongly urged by his counsel, on the ground that he could not have been conscious of an act perpetrated in a half-waking state. This was strengthened by the opinion of a medical witness. The prisoner was, however, found guilty. Under such circumstances, it was not unlikely that an idea had arisen in the prisoner's mind that he had been attacked by robbers, and therefore had stabbed the man in self-defence. (*Reg.* v. *Milligan*, Lincoln Aut. Assizes, 1836.) The following remarkable case is quoted by Mr. Best. Two persons who had been hunting during the day slept together at night. One of them was renewing the chase in his dream, and imagining himself present at the death of the stag, cried out, "I'll kill him! I'll kill him!" The other, awakened by the noise, got out of bed, and by the light of the moon beheld the sleeper give several deadly stabs with a knife on that part of the bed which his companion had just quitted. Suppose a blow, given in this way, had proved fatal, and the two men had been shown to have quarrelled previously to retiring to rest! (Presumptions of Law and Fact.) A defence of this kind may, however, be unduly strained. Thus, when there is enmity, with a motive for the act of homicide, the murderer, while sleeping in the same room, may select the night for an assault, and perpetrate the act in darkness, in order the more effectually to screen himself. In *Reg.* v. *Jackson* (Liverpool Autumn Ass. 1847), it was urged in defence that the prisoner, who slept in the same room with the prosecutor, had stabbed him in the throat, owing to some sudden impulse during sleep: and the case of *Milligan* above given was quoted by the learned counsel, in support of the view that the prisoner was irresponsible for the act. It was proved, however, that the prisoner had shown malicious feeling against the prosecutor, and that she had wished him dead. The knife with which the wound had been inflicted bore the appearance of having been recently sharpened, and the prisoner must have reached over her daughter (the prosecutor's wife), who was sleeping in the same bed with him, in order to produce the wound. These facts were adverse to the supposition of the act having been perpetrated in a state of unconsciousness in awaking from sleep, and the prisoner was convicted. In *Reg.* v. *Minchin* (Cent. Crim. Court, June 1853), in which a young woman was charged with having wounded the prosecutor during the night, the same plea was put forward, but rejected. There was nothing to show that the prisoner was not aware of what she was doing. There was an absence of motive, but, as it has been elsewhere stated, this alone does not create irresponsibility. In another case, *Reg.* v. *French* (Dorset Autumn Ass. 1846), it was proved that the prisoner, while sleeping in the same room, had killed the deceased, who was a stranger to him, under some delusion. There was, however, clear evidence that the prisoner was insane, and on this ground he was acquitted under the direction of the judge.

Somnambulism may become a subject of discussion under a contested policy of life insurance, in which it may be provided that it shall be vitiated by suicide. If a man falls from a height, and is killed while in a state of somnambulism—would this be considered an act of suicide within the meaning of the policy? The proviso against suicide has been held to include only *intentional* killing (See case ante, *Borradaile* v. *Hunter*, p. 903; also, Med. Gaz. vol. 36. p. 826); and in death under these circumstances the killing cannot be said to be intentional: it can only be regarded as an accident. Therefore it is reasonable to infer that the policy would not be void. It is impossible, however, to lay down any general rules relative to cases of this description; since the circumstances attending each case will sufficiently explain how far it was likely that the act of murder or suicide had been committed during a state of somnambulism, or under an illusion continuing from a state of sleep.

THE DEAF AND DUMB.

It was formerly laid down in the old law books, that a person born deaf and dumb was by presumption of law an idiot; but in modern practice, want of speech and hearing does not imply want of capacity either in the understanding or memory, but only a difficulty in the means of communicating knowledge; and when it can be shown that such a person has understanding, which many in this condition discover by signs, he may be tried, and suffer judgment and execution. (Archbold.) A deaf and dumb person is not incompetent to give evidence unless he be also blind. He may be examined through the medium of a sworn interpreter who understands his signs. This condition does not justify restraint or interdiction, unless there be at the same time mental deficiency. A deaf and dumb person who has never been instructed, is altogether irresponsible for any action, civil or criminal. Such a person cannot even be called on to plead to a charge, when there is reason to suppose that the nature of the proceedings cannot be understood. A deaf and dumb female was charged with cutting off the head of her child. By signs she pleaded not guilty, but she could not be made to understand the nature of the other proceedings against her. Upon this she was discharged, and subsequently confined as a criminal lunatic. In *Reg.* v. *Goodman* (Stafford Summer Ass. 1841), a deaf and dumb man was convicted of theft and sentenced to imprisonment. He was made to comprehend the proceedings by signs and talking with the fingers. In *Reg.* v. *Brook* (Buckingham Summer Ass. 1842), the prisoner could read and write well. He was charged with feloniously cutting and stabbing. The proceedings were reported to him in writing. He was convicted, and the judge (Alderson, B.) having sentenced him to a year's imprisonment, handed down his judgment in writing, which he recommended him to read and ponder over in prison! In *Reg.* v. *Jackson* (Bedford Summer Ass. 1844), Alderson, B., held, that before the evidence of a dumb witness can be received, the Court must be satisfied that he understands the obligation of an oath. It has been decided in the Ecclesiastical Courts, that the consent of a deaf and dumb person given by signs, renders a matrimonial contract valid, provided the individual have a full and proper understanding of their meaning. An incompetency to enter into contracts, or unsoundness of mind, must not be inferred to exist merely in consequence of a person's being deaf and dumb. In the case of *Harrod* v. *Harrod* (Vice-Chancellor's Court, June 1854), an attempt was made to deprive the plaintiff of his rights on the ground that he was an illegitimate child. The marriage of his parents took place, thirty years previously, but the marriage was said to be void, by reason of the alleged incapacity of his mother to enter into the contract. The mother was deaf and dumb, and of more than ordinarily dull intellect. Sir W. P. Wood said there was an important difference, between "unsoundness of mind" and "dulness of intellect." The presumption in such cases was always in favour of sanity, and the fact of a person being deaf and dumb, did not raise a presumption the other way. Experience showed, in asylums, that the deaf and dumb were not necessarily unsound. The woman had assented to the marriage in form and substance, and with a perfect knowledge of what she was doing. In the ceremony of marriage it had never been held that the repetition of the words was necessary. The woman conducted herself with great propriety before and after the marriage, and a child was born in due course. There was no ground for an issue.

Feigned deafness and dumbness.—From these statements it will be perceived that medical evidence is of but little importance in relation to the deaf and dumb. Indeed, there are only two cases in which this kind of evidence is likely to be called for:

1st, when there is accompanying *mental deficiency*, in which case the general rules, given under insanity, are applicable; and 2ndly, when there is a suspicion that the deafness and dumbness are *feigned*. There can be commonly no great difficulty in detecting an imposition of this kind. It will be found that the alleged deafness and dumbness did not come on until a motive existed, and that there was no apparent cause but the very suspicious one of evading responsibility for some offence committed. The use of ether or chloroform-vapour may be occasionally resorted to with advantage for the detection of such an imposition. In one instance a strong shock of the induced current from a large magneto-electrical apparatus, by means of moistened conductors applied over the larynx, brought out after a few minutes the power of speech in a lad who had successfully imposed on many persons. (Med Times and Gaz. March 30, 1861, p. 339.) It requires great skill to maintain an imposture of this kind. Such persons are immediately thrown off their guard by addressing them in a voice a little above or a little below the common conversational tone. A change in the eye or the features will at once indicate that they hear and understand what is said. The ignorant impostor may be dealt with on the principle of "*artis est celare artem*," by seriously proposing in a low voice to a medical friend who may be present, the necessity for the performance of some formidable surgical operation. The production of amputating instruments has been known to have a wonderful effect! In *Reg.* v. *Yaquierdo* (Herts Summer Ass. 1854), the prisoner, who was charged with wilful murder, was found by the jury to be wilfully mute. The man refused to plead, although it was obvious that he was well aware of the nature of the proceedings. No counsel could be assigned to him, as this could not be done without the prisoner's consent. He was convicted and sentenced. If the impostor can write, he may perhaps be detected by the ingenious plan adopted by the Abbé Sicard. When the deaf and dumb are taught to write they are taught by the eye. The letters are only known to them by their form, and their value in any word can be understood only by their exact relative position with respect to each other. A half-educated impostor will spell his words, or divide them incorrectly, and the errors in spelling will always have reference to sound,—thereby indicating that his knowledge has been acquired through the *ear*, and not alone through the eye. A man who had defied all other means of detection, wrote down several sentences, in which the misspelling was obviously due to errors produced by the *sound* of the words. The Abbé pronounced the man to be an impostor without seeing him, and he subsequently confessed the imposition.

APPENDIX.

Page 7. Influence of habit on arsenic. The arsenic-eaters of Styria.—In the text I have stated that "there is no satisfactory proof that any human being has ever accustomed himself by habit to take these substances (arsenic and corrosive sublimate) in doses that would prove poisonous to the generality of adults." Since this was written, I have seen a paper by Dr. Roscoe of Manchester on the alleged practice of arsenic-eating in Styria (Manchester, 1861), in which he has published facts, procured apparently from respectable sources, which tend to show, contrary to the opinion here expressed and generally entertained in this country, that there are certain persons in Styria who are capable of eating arsenic in (*Anglicè*) poisonous doses for many years together; and that they not only do not suffer from symptoms of poisoning, but retain a good appetite, and enjoy, as they believe, more than ordinary health and strength. In a case which he quotes, a man took, in one day, $4\frac{1}{2}$ grains, and on the day following $5\frac{1}{2}$ grains of white arsenic, crushing the mineral between his teeth and swallowing it. The man stated to Dr. Roscoe's informant that he took this dose three or four times a week,—his weekly allowance thus amounting to about a scruple of arsenic, a quantity sufficient to kill ten English adults! The day after he had swallowed the second dose, the man left the place in his usual health. There is no further record of him: but as two days had passed without any symptoms: and arsenic was found to be eliminated in his urine, this toxophagist must have been arsenic-proof. The immunity, which it seems the man had acquired, by regularly taking arsenic for twelve years (p. 7), appears, however, to be an exceptional condition in Styria. Dr. Roscoe has furnished other cases which show that arsenic can exert the same deadly power there that it does in England. Among eleven cases of arsenic-eating quoted at p. 12, in No. 1 the man began with pieces of the size of a pin's head ($\frac{1}{15}$ gr.), and gradually increased the quantity up to the size of a grain of oats ($2\frac{3}{4}$ grs.). *Died of the effects of the poison.* No. 2 ate arsenic. Died of typhus (?) No. 4 took arsenic, and raising the dose was seized with *symptoms of poisoning.* He recovered. No. 5 was in the habit of eating arsenic in doses of the size of a grain of wheat ($2\frac{3}{4}$ grs.), a practice which she continued to her old age. She died in 1858,—cause not stated. In two other cases, one man suffered from gastro-enteritis, and another from symptoms of acute poisoning (p. 10).

The German physicians who have reported these instances to Dr. Roscoe, attribute "the large number of cases of poisoning which occur in Styria" to the wide diffusion of arsenic, and, we may add, to the ignorant and superstitious habits of the peasantry. It is admitted that they keep arsenic in their houses for the twofold purpose of poisoning rats and mice, and of flavouring bread and cheese for themselves and their families! Dr. Schäfer of Grätz, who has furnished some of these cases, states that during two years in which he acted in the district as Government toxicologist, no fewer than *thirteen cases of arsenical poisoning* came under his official notice! (p. 6); and Dr. Schallgrüber says:—"The reason of the frequency of these sad cases (of poisoning) appears to me to be the familiarity with arsenic which exists in our country, particularly in the higher parts (p. 7). Acting upon these views, the Government has endeavoured, by law, to put down this suicidal practice by strictly forbidding the sale of arsenic in Styria (p. 7),—a clear proof that in the judgment of competent persons, the poisoning must prevail over the fattening and other alleged sanitary qualities of the mineral.

The well-marked case of arsenic-eating cited by Dr. Roscoe admits of no explanation on English experience. *Habit* appears to have so little influence on this substance under careful medicinal use in this country, that I believe no medical practitioner has ever succeeded in causing a patient to take two grains at a dose (the smallest quantity yet known to have destroyed life). Mr. Hunt, who has perhaps more extensively employed arsenic than other practitioners, fixes the maximum dose at one grain (two drachms of Fowler's solution). In Dr. Roscoe's informant's case, the man swallowed, in two doses, on two successive days, a quantity of arsenic equivalent to *two ounces* and *a half* of Fowler's mineral solution!

There is, however, a difficulty in assigning the tolerance of the poison merely to *habit*. At p. 13, immediately following the eleven cases of arsenic-eating, Dr. Roscoe quotes from Dr. Schäfer, "a most important case of administration of no less than 555 grains of arsenic to a horse in twenty-three days, without any evil effects being produced." It is not stated that the animal began to take arsenic in early life; and habit could have had but little influence in three weeks on the large quantity here given,—even admitting that small doses were given at first and that these were gradually increased. As no evil effects were produced, the only inference is, that by some speciality of organization, arsenic was not a poison to this animal.

Dr. Roscoe has cleared away much of the absurdity published regarding arsenic eating in Styria. Von Tschudi and others have asserted that arsenic could not be safely taken or administered, unless it was commenced about the time of the new moon:—and that symptoms of poisoning by arsenic were manifested in arsenic-eaters, not during the taking of the poison, but on the person ceasing to take it! Dr. Roscoe publishes the case of an arsenic-eater, which shows that this statement is erroneous. A man who had suffered from indigestion and general debility began to eat arsenic. He continued this practice for seven years, and had gradually improved in health. "He had been perfectly well until yesterday (?), when he took rather a larger dose than usual, and was seized with violent pains, which he thought were colic, but which proved to be gastro-enteritis in a severe form. Upon the administration of the usual remedies (for arsenic), especially the hydrated peroxide of iron, the patient recovered in a short time" (p. 10). The doses taken are not stated, nor is the excess which caused the symptoms described. The result, however, shows that the man was not cured by giving him more arsenic, but on ordinary principles, by withdrawing the arsenic and administering to him the antidotes for this poison. It is worthy of remark, as bearing on the non-influence of habit, that *seven years* of arsenic-eating were not sufficient to protect this man from the poisonous action of arsenic when taken in "rather a larger dose than usual."

The Styrians are not likely to find imitators in England. This pamphlet satisfactorily shows that symptoms of acute poisoning, gastro-enteritis, and death are the results of the adoption of this dangerous practice. It would be difficult to persuade an English peasant, however ill-educated, that he could safely put into his daily food a substance which he used for destroying vermin,—or an English woman, that she could safely take, to improve her personal attractions, a mineral which pregnant women were in the habit of using to procure abortion (p. 7). It is a strange and inexplicable circumstance, that the medico-legal writers of Germany have not dealt with this question by a proper investigation of the facts. In the recently published elaborate work of Casper (Practisches Handbuch der Gerichtlichen Medicin, 1857-8), although the subject of arsenical poisoning is very fully treated, there is no reference to the existence of a class of toxophagists in Styria. The recent works of Böcker, Bock, and Otto, as well as the German Quarterly Journals devoted to Legal Medicine are equally silent on the alleged practice. (See a paper by M. Kopp. Moniteur Scientifique, Mars 1861, Liv. 101. p. 106.)

Page 46. Detection of sulphuric acid. Reduction of sulphate of baryta.—The statement published by Dr. E Davy of Dublin

(Chemical News, May 11, 1861, p. 287) regarding the reducing properties of the ferrocyanide of potassium in reference to arsenic, has induced me to test its properties as a substitute for charcoal and cyanide of potassium in the reduction of sulphate of baryta. The results are satisfactory. If the sulphate and ferrocyanide are mixed in equal parts, and heated either in a reduction-tube by a spirit lamp, or in a small porcelain crucible, covered with a layer of mica, the mixture speedily blackens and fuses. The fused residue when cooled may be proved to contain sulphide of barium. On the addition of hydrochloric acid, sulphuretted hydrogen gas is set free, a fact which may be demonstrated by the use of lead-paper as well as by the odour. The gas is mixed with some hydrocyanic acid vapour.

If a reduction tube has been used, the fused mass may be separated by filing off the end of the tube containing it. The mass reduced to powder and placed on a glazed card wetted with distilled water, produces a brown stain of sulphuret of lead. Some fragments placed in a watch-glass and treated with hydrochloric acid, may be proved to evolve sulphuretted hydrogen by inverting over this, another watch-glass containing a piece of filtering paper, wetted with a solution of acetate of lead. A portion of the mixture of sulphate and ferrocyanide may be heated on a stout platinum wire, in the reduction-flame of a spirit-lamp or of a Bunsen's jet. If the wire with the fused mass is then placed on a glazed card moistened with a drop of water, a brown stain of sulphide of lead is immediately produced. This simple experiment renders a crucible or reduction tube unnecessary. I find that the ferrocyanide effects the conversion of the sulphate to sulphide, more speedily and at a lower temperature than charcoal.

In medico-legal analysis it would be desirable to heat an equal portion of the ferrocyanide alone, and test the fused residue in the manner described, in order to remove any objection arising from the alleged presence of an alkaline sulphate as impurity.

Page 52. Detection of a small quantity of nitric acid in nitrate of potash.—In reference to Exp. 3. the best method of proceeding for a small quantity of nitrate unmixed with chloride, is to place in a watch-glass one or two drops of concentrated sulphuric acid with a few copper filings, and then to stir in this mixture the suspected nitrate. Invert over the watch glass another containing a small piece of blue litmus-paper wetted, and a piece of starch-paper moistened with a solution of iodide of potassium. After a longer or shorter interval the litmus will be reddened, and the starch-paper will assume a blue-black colour. If the nitrate should be mixed with much chloride, then the power of dissolving leaf-gold on boiling the salt with strong hydrochloric acid, furnishes the best means of detection.

Page 69. *Symptoms of poisoning by Phosphorus.*—I am indebted to Mr. Parsons of Bridgewater, for a case of poisoning by phosphorus, which adds something to our knowledge respecting the insidious and unexpected manner in which life may be destroyed by this poison. On the 20th April 1861, a girl swallowed a quantity of phosphorus paste. When seen soon afterwards by Mr. Parsons, her lips as well as parts of her dress were smeared with this substance, and there was a strong odour of phosphorus in her breath. Her countenance was tranquil: her pulse regular: there was no sickness or nausea, and she complained of nothing but slight thirst. Her symptoms were so slight that they excited no suspicion that the girl had swallowed the poison. She passed a restless night, and the next day she complained of heat in the mouth and throat, and of a slight sensation of nausea and retching. There was no pain or tenderness in the region of the stomach—the pulse was regular but weak. On the 22nd she dressed herself and was able to walk about the ward: she left the hospital and went home, having walked a mile: she had her tea as usual at night, and went to bed. On the following day, the 23rd, she complained of pain in her bowels with diarrhœa and sickness. These symptoms continued to become worse. On the 25th there was pain in the bowels which were tender on pressure, and slightly tympanitic. The pulse was intermittent, and the girl was fast sinking. She died on the 26th, having survived the effects of the poison nearly a week, and no well-marked symptoms having set in until the fifth day. An inspection of the body was not permitted, and the only fact observed after death was a rapid tendency to putrefaction. The whole of the body became speedily livid, and the finger-nails were blue,—a condition noticed by a witness to have existed before death.

It will be perceived that, in reference to the delay in the appearance of symptoms—their slightness taken as a whole—and the time at which death occurred, this case is similar to one noticed at page 79 of the text — a case of poisoning by lucifer matches. If it were not for the peculiar character of the circumstantial evidence, these cases might easily throw a practitioner off his guard in forming an opinion. The odour of the breath and the appearance of phosphorus smeared over the dress attracted the notice of Mr. Parsons. Other witnesses deposed that whatever deceased touched with her hand, seemed to take fire, and that when she drank water to allay her thirst, a kind of smoke issued from her mouth. Her hands and dress were luminous in the dark.

Pages 83 and 86. *Reduction-process for arsenic.*—In the text the use of soda-flux for arsenious acid,— and of a mixture of cyanide of potassium and carbonate of soda, for the sulphuret of arsenic, has been recommended. Dr. Edmund Davy of Dublin has advised as a reducing agent for either of the above compounds, the *ferrocyanide of potassium*, thoroughly dried at 212°. (Chemical News, May 11, 1861, p. 288.) This salt, so far as I know, has not been before employed for such a purpose by any chemist.

The results are satisfactory. The flux is clean, of a light colour: it does not adhere to the sides ot the reduction-tube, and when mixed in the proportion of two parts of ferrocyaninde to one of arsenious acid or of the sulphuret, and the mixture is heated to full redness, a well defined ring of metallic arsenic is easily obtained. The mixture becomes at first black, it then fuses, and the metallic arsenic is sublimed and deposited in a cool part of the tube. The heat of a spirit-lamp is sufficient, but a Bunsen's burner gives a better result. The ferricyanide of potassium well-dried, equally answers the purpose of a reducing agent, but it has no advantages over the dried ferrocyanide.

The ferrocyanide of potassium should itself be first tested by heating it in a reduction-tube. It undergoes similar changes, by heat, it darkens in colour, fuses and leaves a residue, which dries to a greenish black colour, but it yields no metallic sublimate whatever. I have tested the fused residue in the tube after the ferrocyanide with arsenic had been heated to full redness for some time. There was a mere trace of arsenic left, a result which is invariably observed when the reduction of arsenic takes place in contact with an alkali or an alkaline carbonate.

Page 93. *The detection of arsenic in copper.*—The method described at the foot of the page for the detection in and separation of arsenic from metallic copper was, I believe, first devised by myself and employed in the analyses for arsenic required in *Reg.* v. *Smethurst*, in June and July 1859. It has an advantage over other methods in this respect, that it requires the use of only *one* chemical compound (hydrochloric acid), the purity of which may be easily tested. It was in the summer of 1859 that by this new process I demonstrated to my friend Professor Brande the presence of arsenic in samples of copper which had been supplied to the Royal Mint as free from that metal. I also detected it at the same time by this process in samples of copper furnished to me by five distinguished chemists practising in England, Ireland, and Scotland.

Page 96. *Distillation-process for arsenic.*—The great facility with which arsenic was entirely separated from metallic copper by distillation with hydrochloric acid, in the process referred to in the preceding paragraph, induced me at the same time

(June and July 1859) to try the effects of distillation for the separation of arsenic from antimony, mercury, bismuth, and iron. The results were on the whole satisfactory. In some of the experiments it was found that more than one distillation was necessary for the purpose of a complete separation of the arsenic. On further trials I found that arsenic, whether in the absorbed or in the free state, was thus completely separated from dried organic matter. The chloride of arsenic produced in this process has been long known as a volatile compound. In 1841 it was obtained by Dupasquier in distilling a solution of arsenious acid in hydrochloric acid. (Pereira. Elements of Materia Medica, vol. 1 p. 720.) Pereira repeated these experiments and obtained the liquid called by Dupasquier the terchloride of arsenic. In 1846-7 I found, in using Reinsch's process in numerous medico-legal analyses, that there was occasionally a great loss of arsenic; and in May 1847 I satisfied myself by direct experiment that a quantity of arsenic was uniformly distilled over with the hydrochloric acid. The only use which I then made of the volatile product thus obtained, was to apply to it as well as to the residue in the retort, the process of Reinsch. These experiments were published in detail in the first edition of my work on POISONS (November 1847), p. 363. In 1849 my friend and colleague, the late Mr. Arthur Aikin, in his lectures at Guy's Hospital, demonstrated the method of procuring chloride or butter of arsenic by distilling a mixture of salt and sulphuric acid with arsenious acid. With the exception of the experiments made by myself in 1846-7, these well known facts were not applied to the purposes of toxicological research. Dr. Schneider of Vienna was the first to employ them in a practical form for the separation of absorbed or free arsenic from organic matter. In 1851-2 he published an account of his method, which consisted in mixing an excess of common salt with the organic substance, and then distilling the mixture with strong sulphuric acid. This was the chemical process which had been pursued by Mr. Aikin two years previously for the purpose of procuring chloride of arsenic. This process, which was adopted by Otto and other German chemists, is well known on the continent, and has been noticed in most works on toxicology under the name of *Schneider's* process. Dr. Schneider has published the most complete account of it in his Gerichtliche Chemie, Wien, 1852, p. 206, with an illustration of the apparatus which he used. A description of Schneider's process was also published in the Pharmaceutical Journal for July 1853, p. 38. It appears to have found but little favour in this country. The only chemist who, so far as I know, employed it for medico-legal purposes, was Dr. Clark of Aberdeen. In the fifth edition of my Medical Jurisprudence, published in 1854, I thus refer to it at p. 80: "M. Schneider, and after him Dr. Clark of Aberdeen, has suggested that the arsenic contained in organic liquids or solids may be procured as chloride in a receiver by distilling the organic matter with a mixture of common salt and sulphuric acid. The chloride of arsenic thus obtained in a pure state may be subsequently analyzed by any of the usual processes."

To Dr. Penny of Glasgow the credit is due of having first employed for the detection of *absorbed* arsenic, the process of distilling the viscera with pure hydrochloric acid in place of a mixture of salt and sulphuric acid. It appears that Dr. Penny employed this process so far back as 1852, but as he mixed water with the acid, no chloride of arsenic appeared in the first portions of liquid distilled. This distillation-process was subsequently used by Dr. Penny and Dr. Christison in the case of L'Angelier in 1857. (Report of the trial of Madeleine Smith, by Irwin, Edinburgh, 1857, p. 61.) The reader has now before him the complete history of this process from the earliest experiments of Dupasquier in 1841. The facts and dates will enable him to judge of the title of any new claimant to be the discoverer of what I believe will ultimately turn out to be a valuable method of detecting small quantities of arsenic when contained in much organic or inorganic matter. For a more complete account of this method of separating arsenic I must refer the reader to a paper entitled "Facts and Fallacies connected with the Research for Arsenic and Antimony," in the Guy's Hospital Reports for October 1860, p. 201.

Pages 590, 592. *Proofs of life after birth.*—The case of *Brock* v. *Kelloch*, briefly noticed in the text, has led to some discussion in the medical journals. (Lancet, May 11, 1861, p. 469, and May 18, pp. 488 and 493.) Mr. Hurd of Frome has furnished some additional facts in reference to the question at issue. In July 1849 a woman gave birth to a female child, as she believed, in the eighteenth week of her pregnancy. The child was supposed to be dead and placed aside. Some time afterwards Mr. Hurd's attention was called to the child by some of the attendants, who had observed convulsive movements of the body. These continued for half an hour, and the action of the heart was evident to the eye from the pulsation it communicated to the chest as well as to the hand. There was no visible respiration at any time, but there can be no reasonable doubt that this child was *born alive.* In October 1852, in attending another woman, Mr. Hurd noticed that the navel-string ceased to pulsate eight minutes before entire delivery. The child was born apparently dead: it was corpse-like in appearance, and its limbs were flaccid. By the aid of a hot bath and inflation of the lungs continued for twenty minutes, the lips acquired a slight colour, and there was a feeble sigh. After the inflation had been continued for three quarters of an hour the lips and face became more tinged, and respiration was established. This case clearly shows that the act of respiration is not necessary to the presence of life in new-born children. Any physician insisting on this proof, would have pronounced this child to have been still-born or dead, thirty minutes after its birth, and have given a certificate accordingly; while after forty-five minutes he would have been equally prepared to give a certificate that the same child was born alive! The child was alive and well at the time the case was published, *i. e.* nine years after the birth. There can be no doubt that from this erroneous doctrine respecting the necessity of evidence of *respiration* at birth as a proof of life, many children are consigned to certain death, when by the application of proper means the latent, might have been converted into active life.

In justifying his opinion in the case of *Brock* v. *Kellock*, Dr. Ramsbotham refers to a case in which a woman was suddenly delivered of a child while sitting over a slop-pail of dirty water. On examining the body of the child, there was no sign of respiration in the lungs, but a quantity of dirty water was found in the stomach. According to Dr. Ramsbotham, this fluid had been *swallowed* by the infant under some futile attempts to breathe. From the state of the lungs, the coroner directed the jury that the child was born dead: but the facts proved that the child must have had the power of swallowing after birth,—and therefore, in spite of the condition of the lungs, that the child came into the world alive, unless it be contended that the power of swallowing may be exerted by a dead child. (See Lancet, May 25th, 1861, p. 521; also May 11, 1861, p. 469.) This and the following case, which occurred to Dr. D'Aulnot are strongly adverse to the view that respiration is or ought to be the only sign of life after birth. An infant was found dead in a privy. The lungs sank in water on applying the hydrostatic test; but as fæcal matter was found in the stomach, some experiments were instituted in order to determine whether the child was living or not when it was dropped into the privy. From these, it resulted, in the opinion of Dr. D'Aulnot, that the presence of any foreign body, whether solid or fluid, in the digestive tube of a new-born infant, is a proof that deglutition has taken place; and deglutition being a vital process, that life existed at the time of its occurrence. (Moniteur des Sciences Méd. 1860, No. 114; and Med. Times and Gaz. June 1, 1861, p. 591.) These facts have an important relation to the evidence of live birth in criminal cases (*ante*, p. 473).

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